

# ROADS and STREETS

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General View of the Stabilizing Plant.

## PRODUCTION AND USE OF STABILIZED MAINTENANCE MATERIAL IN SOUTHWESTERN MICHIGAN

*A 4000 Cubic Yard Job in Berrien,  
Van Buren and St. Joseph Counties*

By JOHN C. BLACK  
*Field Editor, ROADS AND STREETS*

**C**HANGES in the proportions of the gravel-sand-clay-chloride mixture, and improvements in production methods give special interest to a maintenance project completed in May by the Berrien, Van Buren and St. Joseph County Road Commissions and the Michigan State Highway Department. Methods and equipment used in applying the material to road shoulders, though not new, will be of interest to engineers and superintendents not already familiar with them.

### Specifications and Contract

Production of the material is under Michigan State Highway Specifications, Maintenance Gravel 23A. In-

structions to bidders provide in part as follows:

"The quantity of clay should be estimated at 15 per cent of the produced gravel, however, the Department reserves the right to increase or decrease this quantity depending upon the nature of the 23A Gravel and clay.

"The 23A Gravel or 19A Crushed Mine Rock will be measured in cubic yards, loose measure, in the truck at the site of the stock pile. Measurement will be made before the clay is added.

"The cost of, or royalty for, gravel, crushed mine rock or clay, regardless of location or ownership, shall be paid by the Contractor and shall be included in the unit prices bid.



General View at Gravel Pit. The shovel dumps its load on a grizzly above the mine-entrance-like opening from which it is delivered by belt conveyor to the crusher.

"The materials shall be stocked in such a manner as to prevent segregation. When the award is made on the price in stock piles along the road, the stock piles shall be placed at the sites designated and shall be built up in the shape of truncated prisms and shall be readily available for trucks to load the material."

#### Materials Specifications

23-A Gravel—	Per Cent
Passing $\frac{3}{4}$ " square screen.....	100
Passing $\frac{1}{2}$ " circular screen.....	60-85
Passing No. 10 sieve .....	25-40
Gravel (uncrushed), abrasion not more than.....	20
Gravel (crushed), abrasion not more than.....	30

**Clay**—The clay shall be approved by the Engineer on the basis of laboratory tests conducted on mixtures of the clay with the produced 23A Gravel.

**Processing Pre-Stabilized Gravel**—The required amount of approved clay, as determined by laboratory tests conducted by the Engineer, shall be added and uniformly mixed with the 23A Gravel by means of a pug-mill, a clay feeder and shredder or other approved auxiliary equipment in order to insure quick and complete compaction of the material when placed on the road. Other methods of adding clay and mechanically mixing it with the gravel at the processing plant will be permitted if approved by the Engineer. Water may be required in the mix to provide for proper compaction. When required, the water shall be added to the mixture at the processing plant in the amount determined by the Engineer.

**Use of Admixtures in Processing Pre-Stabilized Gravel**—When required, calcium chloride, sodium chloride (salt) or natural brine shall be used in the pre-stabilized gravel and shall be combined with the gravel and clay at the processing plant in the amount specified. The State Highway Department will furnish and deliver the admixtures to the processing plant.

The contract unit price for pre-stabilizing (processing) the gravel shall include the cost of handling and mixing the admixture with the gravel and clay without additional compensation.

#### Quantity, Price and Distribution of Product

By fortunate geological coincidence, all the natural materials are available within a radius of 100 yards at

the Duback gravel pit some ten miles northeast of Benton Harbor. This pit is owned by the Berrien County Road Commission. Preparation of an even 4,000 cu. yd. of the stabilized mixture was contracted to John G. Yerington of Benton Harbor at \$1.67 per cu. yd. excluding the calcium chloride, which was furnished by the State Highway Department. This price was at the plant. Division among the counties was as follows: 2,100 yds. to Berrien, 1,000 yds. to Van Buren and 900 yds. to St. Joseph.

The Berrien County portion was hauled directly from the plant to the job, and distributed in place on U. S. Route 12 near Benton Harbor and at other points, the maximum haul being about 10 miles. Van Buren County



Another Dipperful on the Bars.



Crushing and Screening Plant.



*At left, the Proportioner and Disintegrator. The chloride hopper is full and shows white. Above and to the left of it is the discharge end of clay conveyor. Aggregate hopper is outside the picture at the left. At center, Conveyor Belt leading to Pug Mill. At right, the pug mill and a truck loading from it.*

material was stock-piled at various points for use as needed, maximum haul being 17 miles. Material for St. Joseph County was stock-piled at the pit.

#### Raw Materials and Finished Product

The pit is located on a hillside, the maximum cut being about 25 ft. in gravel. Clay was found underneath the gravel near the foot of the hill. The shovel, which worked most of the time in gravel, was used as needed to excavate the clay, but was required for comparatively brief periods in the latter service.



*The Clay Pit. Upper end of crushing and screening plant is visible near left edge of picture.*



*Pug Mill*

Haul of the finished product from pugmill to highway was uphill, and haul from clay pit to clay stock pile was approximately level, but otherwise the movement of materials was practically all down grade.

Pit-run material from the gravel bank is surprisingly close to specification requirements after the larger stones are crushed to pass a  $\frac{3}{4}$ -in. screen. Sand, totaling 37 per cent, is well within the 25 to 40 per cent limits; while a 10 per cent clay content by weight is only moderately short of the total required. The additional 5 per cent of clay is supplied from the pit already mentioned. It is of the generally execrated tough, sticky, blue variety, but was suitable for stabilizing purposes, and was welcomed because of its favorable location. The picture indicates its position below the gravel deposit. A considerable sand content makes it necessary to use more than a bare 5 per cent of material from this pit in order to secure the required 15 per cent clay total. The deposit carries occasional stones of several inches maximum dimension, but these are all rejected automatically at the disintegrator.

The 17 lb. of calcium chloride per yard is added to the clay and aggregate on the conveyor belt leading to the pugmill.

As it comes from the proportioning plant, the finished stabilized mixture is of a dark reddish brown color with the clay well distributed, and a strikingly uniform texture. It contains from 7 to 10 per cent of water.

#### Equipment and Production

**Gravel Pit**—Beginning at the gravel end, a  $\frac{3}{8}$ -yd. Northwest shovel handles material from the bank to the grizzly. As its capacity is more than enough to supply material for stabilization, it loads a considerable number of trucks directly with bank-run material for other purposes. On the day of my call it was busy every minute. Material passing the grizzly is received on a conveyor belt leading to the crusher—a No. 100 truck-mounted Austin-Western, 4 years old and giving perfect service. Some of this material is hauled away for other uses, but the portion for stabilization is trucked about 250 ft. to the stock pile and dumped. On the flat top of this pile, a





*Proportioner and Disintegrator: At right, Clay Hopper; at center and left, Clay Conveyor Delivering to Shredder; at lower left, Chloride Hopper Discharging to Belt Leading to Pug Mill. Crane Bucket Is Directly Over Aggregate Hopper. Chloride Bags in Foreground.*



*Proportioner and Disintegrator. Clay Hopper and Power Unit at left; Aggregate Hopper at center, with Feed below; Stone Ejecting Spiral at right above letters ENE; Small Shredder Roll at right and below letters.*

bulldozer operating from time to time pushes the material over the edge of the bank into reach of the crane which serves the disintegrator and mixer.

**Stabilizing Plant**—The first main unit here is the combined proportioning plant and clay disintegrator (or shredder). This is a product of Barber-Greene Co., and as the first of its kind to be put in service, is attracting much interest. It delivers a mixture of aggregate (sand and gravel), clay and calcium chloride proportioned to specifications and ready for final mixing in the pugmill. A  $\frac{3}{8}$ -yd. Michigan Power Shovel Co. crane handles aggregates and clay from stock piles to the respective hoppers.

The clay is proportioned out of the receiving hopper and delivered to two high-pitched screws which throw out any large stones that might clog or damage the shredding rolls. Along with the stones go large, hard lumps of clay, but the quantity of material so lost is negligible. One of the pictures shows the pile of material thus rejected—part stones, part clay. After the elimination of stones the clay passes to the shredder rolls, the larger having a diameter of 24 in. and a speed of 100 r.p.m., while the smaller, 14 in. in diameter, makes 500 r.p.m. The rolls are spaced about  $\frac{3}{16}$  in. apart, and their unequal speeds produce a tearing action on the clay so that it comes out either in small bits or in flat sections of such weakened texture as to break up very quickly and completely in the pugmill. The clay which was being put through on the day of my visit was quite moist, and

resulted in a considerable portion of flat, fragile pieces, but I am informed that dry clay is reduced almost entirely to powder and small particles.

The ingredients of the stabilized mix are delivered to the conveyors by fully adjustable automatic feeds—a pan feed for the aggregate, a bar feed for clay, and a chain feed for calcium chloride. An important point in this connection is that the clay is discharged from the shredder rolls in a thin, even layer on top of the layer of aggregate in the conveyor belt leading to the pugmill, thus preventing its recombining. Shredded clay discharged directly on a belt, or delivered independently to the pugmill, tends to recombine, with resulting injury to the product. Calcium chloride is delivered to the conveyor immediately after the clay, and the great evenness with which the three materials are proportioned is observable as they lie in the belt. The proportioner and shredder is powered with a 70 h.p. Wisconsin motor—the pugmill with a 90 h.p. Wisconsin.

The foreman informed me that the disintegrator was producing a little more than a yard a minute and could turn out  $1\frac{3}{4}$  yards if necessary. Pugmill capacity is considerably greater. The twin pugmill is of a continuous type, having a special discharge cut-off gate which permits quick change of trucks without spillage and without stopping the mill between trucks. Water is added according to the operator's judgment to produce a consistency best suited to the work.

### Crew and Plant Operation

Five men form a normal crew at the gravel plant:

1 foreman and crusher operator.

1 shovel operator.

1 man at grizzly.

1 man picking turf and other foreign matter from conveyor belt.

1 utility man.

The bulldozer on the stock pile is operated by the utility man or a spare truck driver.

Five men also suffice at the stabilizing plant:

1 foreman.

1 craneman

1 man handling calcium chloride and looking after disintegrator.

1 pugmill operator.

1 man levelling trucks.

Two cords leading to the pugmill from control levers on the disintegrator enable the operator of the former



*Proportioner and Disintegrator: The following features are observable in order from left to right: Aggregate Hopper with Aggregate Proportioning Feeder below; Small Shredder Roll (below gear case near center of picture); Stone-Ejecting Spirals (end view) and on the ground below, a Pile of Rejected Material; End of Clay Conveyor discharging into Hopper beside Spirals; Chloride Hopper discharging onto Conveyor Belt to Pug Mill.*





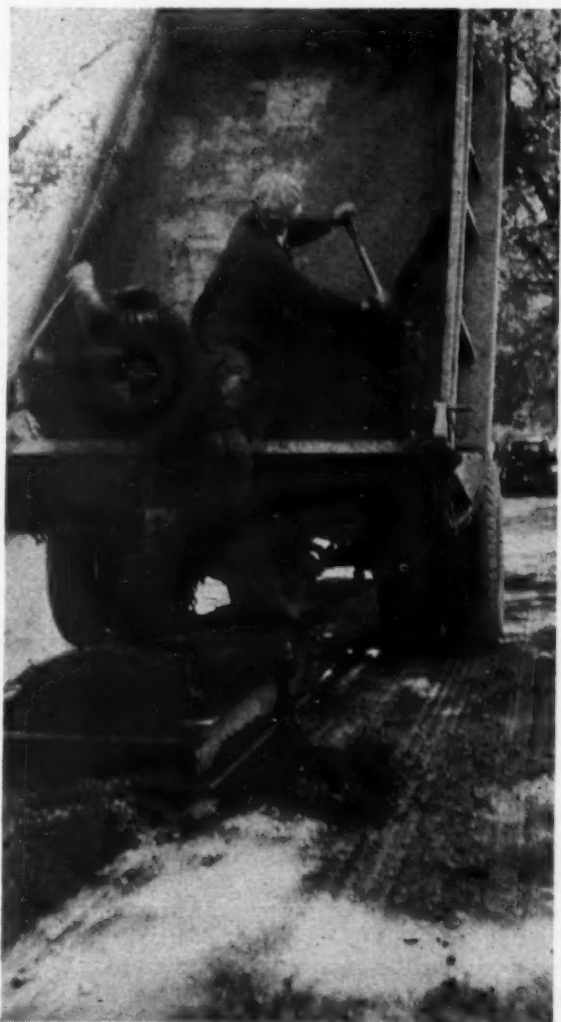
*Gravel Sled Hitched to Truck.*

unit to stop or start the supply of material reaching his machine.

Handling equipment has varied from day to day according to distance and other factors. I found eight 4-yd. hired trucks hauling to Van Buren County, and ten State Highway trucks of 2 to 6-yd. capacity carrying material to Berrien County's work near Benton Harbor.

### **Application of Stabilized Material to Shoulders**

Road operations as I saw them on May 11 consisted entirely in repair of shoulder ruts at the edge of the con-



*Rear View of Gravel Sled in Operation. Note how tail bar is raised higher at outer edge to provide greater thickness of material.*



*Stabilized Material in Place Before Rolling by Trucks.*

crete, and the filling of holes and evening of shoulders for a distance of 18 to 24 inches beyond the pavement edge. The same material, however, is used frequently for much wider and more comprehensive work. Distribution on the ruts is done with a simple device, made in the Highway Department shops and known as a "gravel sled." It consists essentially of two light weight, 8-in. I-beams, with webs cut out at the front end and lower flanges turned up to form runners, with front and rear cross members framed to leave a clear space of 18 in. between runners, and a tail bar adjustable by a hand screw at each end. The bottom between runners is entirely open. The total length is about 8 ft.

In service, the sled is chained close up to a truck having a narrow tail opening through which the stabilized material flows directly into the sled. For material used on this job, the chain is fastened to the sled at a point about  $\frac{1}{3}$  of its length back, but for heavier material, with which it is sometimes used, the hitch is made close to the front end to prevent lifting.

The sled is pulled with one runner resting on the pavement edge and the other on the shoulder. So far as I could see, there was no difficulty in keeping this position with practical exactness.

The tail bar, serving as a strike-off, was adjusted to leave an average of about  $2\frac{1}{2}$  in. of loose material on most of the work, but deposited as much as  $6\frac{1}{2}$  in. on ruts or holes having a depth of  $4\frac{1}{2}$  in.—about the maximum on this job. This provides 2 in., or about 30% for



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compaction. Where the shoulder slopes away from the pavement, as it does in most cases, the bar is set to deposit a greater thickness at the outer edge than at the inner, thus allowing for greater compaction where the material is deepest. The adjustment, of course, is a very rough one.

The old shoulder surface on most of this Michigan work was of stabilized material similar to that now being placed, but about 7 years old. Though rutted and worn, it was generally very hard. Before application of repair material, it was scraped with a 6-ft. light Adams grader. No water was being used at the time I saw it, but the foreman informed me that in some cases they sprinkle the surface before applying new material. He favors a fairly wet mix.

The crew consists of a foreman and 3 men—one on the truck to keep material moving through the tail gate, one riding the sled and keeping material adjusted in it, and one cleaning up along the pavement edge.

Each truck, as it comes on the job, drives with its outer wheels on the new strip, thus supplying the necessary rolling. I am informed that a roller was used on earlier work of similar character, but that the truck rolling has proved better. On a wider strip, however, trucks might be less practical. An interesting detail in this connection is that truck drivers are instructed that the first one over a strip of newly deposited material shall drive with his wheel on the outer edge of the strip in order to prevent squeezing out or spreading. In spite of this, some spreading does occur, and there are places where



*Stabilized Material Several Hours After Placing. Surface has dried to a lighter color than in the preceding picture.*



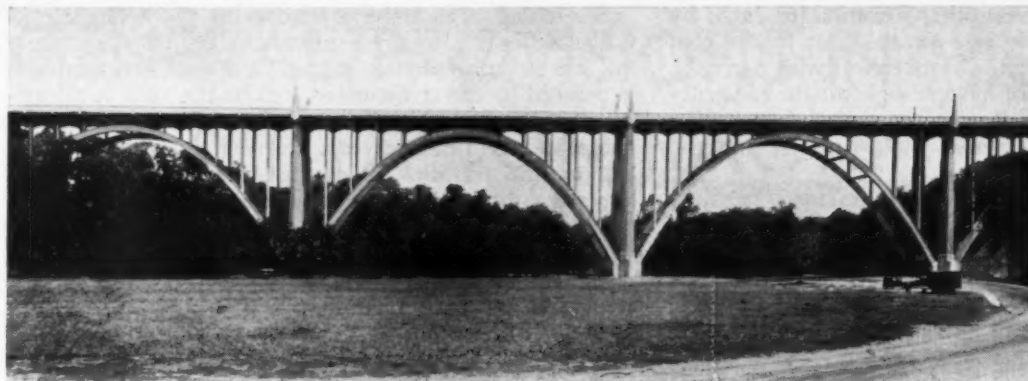
*Stabilized Material After Passage of Two Trucks.*

the new material at first appears not to adhere well to its base; but on this point, the foreman assured me that with a little time and the continued rolling by traffic, practically all the material was bound in.

Obviously such work progresses fast, and it is not surprising to be told that as much as 12 miles of strip can be laid in a day. This very speed, however, complicates the problem of truck supply. If the haul at the end of the day is 10 or 12 miles longer than at the beginning, it is obvious that more trucks will be needed to keep the gravel sled and crew busy; but as it is almost never possible to make such rapid changes in number of trucks, the sled crew, of necessity, will be left idle for considerable periods. Actually, an average good day's work is about 7 miles. The establishment of stock piles at fairly frequent intervals along the route would permit a good adjustment of trucks, but the cost of rehandling material probably would exceed any saving that could be made in the efficiency of the distributing crew. When trucks are coming slowly this crew could, perhaps, be reduced to three men.

▼

**MEXICO TO ISSUE \$10,000,000 HIGHWAY BONDS—** The Mexican government has authorized an issue of internal bonds for highway construction purposes, amounting to 20,000,000 pesos (\$10,000,000). It is understood that the greater part of the proceeds will be used in furthering construction of the Mexico City-Nogales and Mexico City-Suchiate highways, and for improvements to the highway between Mexico City and Acapulco.



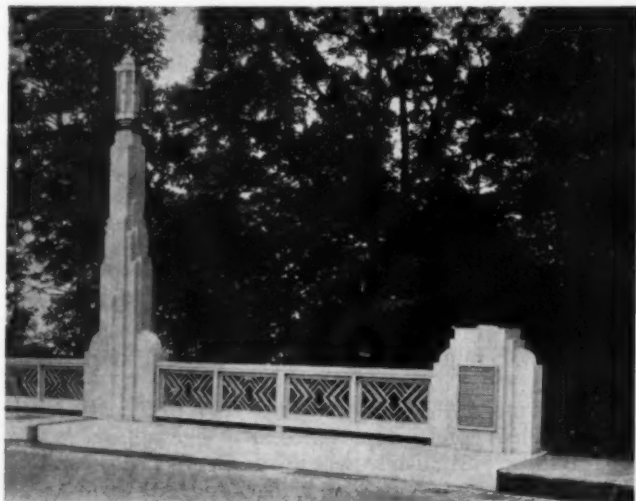
*A View of the Sweeping Lorain Viaduct From the Valley Floor.*

## VISTAS—

### WHY NOT OPEN UP BRIDGE HANDRAILS?

By ANDREW W. PISHTA

VISTAS for hungry eyes may be a poetic expression but it represents an objective which wins growing consideration in the serious business of building bridges. In simpler language, modern bridge design is placing emphasis on appearance and styling. Furthermore, the design of auxiliaries, and particularly the visibility afforded by bridge railing, has a large influence on the attainment of the desired modernistic and utilitarian effects.



*Fig. 1.—Open Style Grilles on the Railing of the Lorain Viaduct, Cleveland, Ohio.*

Strength, toughness, durability—these are the familiar words and matters of usual concern in the engineer's world of stress and strain. They have been important in the development of stronger and safer structures. Nevertheless, to Mr. and Mrs. Public, they are still minimum essentials, and the present day bridge constructor, as well as the designer in other industries, is faced with the task of satisfying an aesthetic need; meeting so to say, an added but unwritten specification.

This added consideration of aesthetic appeal may complicate production problems but it expands usage and business potentialities; it can be equally influential in winning early popular endorsement of public works im-



*Fig. 2.—Flat Arch With Malleable Iron Handrail That Permits Appreciation of Vista. Panther Hollow Bridge, Schenley Park, Pittsburgh.*

provements. Irrespective of the industry involved, the public is the final purchaser and its approval is reflected in a buildup of demand for additional projects.

Early civil engineering as applied to bridge construction was able to give little thought to such considerations. The oldtime spans were built to carry the load, and the sight of what is now to us ungainly superstructures, was of little moment to the builders. Utility was the goal of that time. However, a psychological sense of annoyance



*Fig. 3.—Modernized Handrail on Old Stone Bridge, Lincoln Avenue Bridge, Pittsburgh.*



at the cloistered, view-interrupting sensation produced by a multitude of beams and cross-members, or by the cold surface of a solid fence wall, was often left with users.

With the introduction of modern lightweight construction came opportunity to develop the graceful, sweeping spans typical of many recently built bridges, and the

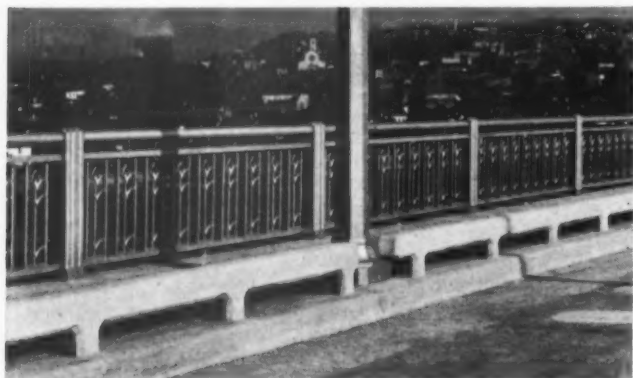


Fig. 4.—Detail of Heavy Duty Guard Rail on Pittsburgh-Homestead High Level Bridge.

chance to decorate with pleasing accessories. Two outstanding examples, one bridge spanning a busy river, the other stretching across a tree filled valley, serve to illustrate the development.

In what is called the "bridge center of the nation" is the recently opened Pittsburgh-Homestead High Level Bridge, a continuous truss type structure, 3,200 feet long, with sloping deck and cantilevered sidewalks. The bridge represents an achievement in beauty as well as in



Fig. 5.—Note How a Solid Wall Handrail Obscures Vision. Boulevard of the Allies, Pittsburgh.



Fig. 6.—An Example of Open Grillework and Heavy Duty Concrete Curb Guards, Washington Road Bridge, Pittsburgh.

practicality, and its attractive general lines are enhanced by harmonious fittings. The malleable iron railing panels and posts, lamp standards and light or trolley poles more than meet the practical requirements and provide an example of interesting design in which the graceful structure has been accompanied with finishing touches which add a logical completion to the motif.

Stretching across the lowlands on the west side of Cleveland is the Lorain Viaduct, another trim product of the bridge construction industry. Users are favorably impressed by the structure as well as the view it affords. A glance over the railing or through the open style malleable iron grilles gives a pleasing sight of vegetation and natural terrain. From the valley floor, the bridge appears light and graceful, blending softly with its surroundings.

As these and other examples will serve to indicate, visibility has special significance in bridge railing construction, and it is obtained by the execution of trim, open style panels and grilles. The appeal of such design goes beyond the matter of ornamental shape and may be said to be based on a combination of graceful lines against a natural background.

Open style railing also provides bridge users with the opportunity for noting the landscape and absorbing the vistas of natural beauty. At the least it will remove the psychological sensation of confinement. Many varied and pleasing designs which provide that essential visibility can be designed; and, in each case, the metal framework can be likened to a lace window curtain which adds



Fig. 7.—Another Example of Obstruction of View by Solid Wall Handrails.



Fig. 8.—Note Pleasing Effect of Open Malleable Iron Grillework.

its touch of refinement and grace without obstructing the view.

Furthermore, the subject has a very practical aspect. Visibility has safety importance at bridge approaches or near ramps, particularly where roadways are curved or large intersections exist at bridge ends. Fig. 5 is an illustration of how solid walls obstruct vision and add traffic uncertainty to motorists. Fig. 7 is a view of another bridge where solid walls were employed on the approaches. Figs. 6 and 8 are examples, however, of provision for visibility around curves and near ramps by use of open style railing.

These attainments of visibility and pleasing effects in bridge railing construction are achieved without the sacrifice of durability or safety standards. For modern bridge use, however, light pedestrian-type railings appear desirable and the strong, concrete curb-guards adjoining the vehicular roadway can perform a traffic safety function. The use of these heavy curb-guards, which are too low to obstruct vision, offsets the elimination of concrete in occasional railing construction and directs this material to a more advantageous use in bridge work.



# GENERAL PROVISIONS IN HIGHWAY CONTRACTS

By J. L. HARRISON

Senior Engineer, U. S. Bureau of Public Roads,  
Washington, D. C.

**I** TAKE it for granted that you are so familiar with the general provisions which customarily appear as the first several pages of the specifications which are made a part of your contract that they are largely accepted as a matter of course and that, perhaps, the thought that they may deserve consideration and possibly some alteration does not often occur to you. And then, again, perhaps it has occurred to you that these provisions would warrant further study—particularly when something has developed which you felt ought to be handled in one way, only to find that one of these same general provisions indicates pretty definitely that you have agreed that it shall be handled in some other way.

Be this as it may, these provisions are of much importance to you, as contractors, because they recite the conditions of award, the general conditions that govern the execution of the work, the rules that govern extensions of time, the acceptance of the work and increases and decreases in the amount of the work you may be asked to perform; to say nothing of other matters of more or less consequence affecting both your rights and your responsibilities as a party to a highway construction contract.

**Sincere Effort to Provide for Contingencies**—For the most part these provisions reflect the best judgment of the engineers and the attorneys who hold responsible administrative positions in our state highway organizations and, as such, they deserve both the highest respect and a definite recognition of the fact that they are a sincere effort wisely to provide for the numerous contingencies that inevitably arise in connection with the execution of any large construction program. Indeed, it is no more than a proper recognition of the fair-mindedness of those who have worked on the perfection of these provisions to remark that serious complaint concerning them is all but unknown and that even mild criticism of them is rare.

But the fact that they are the result of long and both careful and sincere work should by no means lead to a conclusion that improvement in them is impossible. Moreover, for the most part they reflect the viewpoint of the engineers who have carried the responsibility of administering construction programs. As, until comparatively recently, contractors have had few strong organizations through which they could speak concerning such matters, it should surprise no one that they less definitely reflect the viewpoint of contractors. On the other hand, that constructive suggestions by contractors' organizations would be of assistance to those who are dealing with specification revisions is, I believe, beyond question, and this remains true whether the revisions under consideration affect specifications that will be used only locally or are of nation-wide importance.

**Revised General Provisions Being Prepared**—At the moment interest in this particular matter centers on the work that is being done by a sub-committee of the Construction Committee of the American Association of State Highway Officials. This sub-committee is working

on the preparation of revised general provisions which it is hoped will be accepted by the association and through the association accepted as standard throughout the country.

The fact that this work is being done and that it is likely to have a great deal of influence, presents contractors with an unusual opportunity to encourage the consideration of their point of view as to what these general provisions should contain, with every confidence that progressive suggestions made to this sub-committee will prove to have a far-reaching effect. Mr. W. W. Mack, Chief Engineer of the State Highway Department, Dover, Del., is the chairman of this sub-committee. If your branch, or any other contractors' organization has suggestions concerning these general provisions it feels should be considered, they may be presented to Mr. Mack with entire confidence that he and the gentlemen who are working with him will give them careful and most friendly consideration. In fact, your active interest in this matter would be appreciated. Your suggestions are definitely desired.

During the course of an address of this sort, it is not possible to discuss all of the requirements that appear in the Standard Provisions to which you might find it worth while to give some consideration. However, in what follows an effort will be made to note some of the more important of these requirements.

**Withdrawal of Bids**—For practical purposes your first contact with the contract is made in the submission of your proposal and the first point concerning it that is at all likely to raise any serious question, is the specified right you may or may not have to withdraw it, once it has been submitted. Practices as to this matter vary a good deal. In some places it may be withdrawn at any time before it is read by merely making a verbal request for its return. In those places where a written request is required, the period during which such a request may be presented expires at various times before bids are to be opened. This may seem to be a very trivial detail; nevertheless it is one concerning which the opinion of contractors as to the most desirable procedure would be helpful.

**Mistakes in Bids**—Then there is the matter of those mistakes—real "honest to goodness" mistakes—which are only discovered after the bids have been opened. Such mistakes are made. Perhaps you are personally familiar with a few of them! And they are pretty apt to prove costly because, as matters now usually stand, it is hard to prove that that "too low" bid really was a mistake. I believe most engineers would agree that they have no desire to take advantage of actual mistakes. Any light that can be thrown on how this matter can be handled so as to improve existing practices should prove beneficial.

In the preparation of your proposals it is usually required that the bid prices shall be shown in figures and in writing and that either one or the other will control. In some cases the extensions of these bid prices, that is the

unit prices times the number of units involved, control. As to this matter there is, then, considerable divergence of practice and no settled opinion as to whether the figures, the writing or the extensions should control.

Almost invariably the state reserves the right to correct minor errors and to waive technicalities. This is a desirable reservation but there are few, if any, specifications in which minor errors and technicalities are so clearly defined as to avoid arguments and differences of opinion as to just what these things are.

I recently saw a tabulation of bids on a project on which one of the bidders bid \$4 per pound—write it out in words!—for the steel to be used on a job of some size. In figures he wrote 4c a pound. The item was extended at 4c per pound. His bid would have been low by several hundred dollars except for a provision in the specifications to the effect that in the event of a difference between the written words and the figures the written words should govern. Was this a "technical error" or not? You may be inclined to assert that such mistakes do not occur—but the fact is that they do, and rather often, too! If the intent of the bidder is perfectly clear, should the public be penalized the difference between his bid and the next higher bid merely because he has made a careless error? For substantial reasons you prefer that the work should not be readvertised. What attitude do you feel that the state should maintain in a matter of this sort and reflect in the general provisions?

**The Bidder's Certified Check**—And, take the case of the man whose bidder's check was \$11 too small on a \$250,000 job. The next bidder's price was some \$12,000 higher than the price of the low bidder who, it may be observed, was an eminently responsible contractor. A last minute recalculation of his bid had increased it a couple of hundred dollars over the preliminary figure against which his certified check had been secured. Was this a technical error the state should be permitted to waive, or should the job be readvertised or should the public have paid the bill? Illustrations could be extended indefinitely. They might be interesting but they would hardly answer the question. After all, what is a technicality? It's your views that we would like to receive.

**Disqualification of Bidders**—Another matter. Practically all specifications provide rules to govern the disqualification of bidders. Where prequalification is in effect, the number of cases in which bidders must be disqualified naturally is somewhat reduced. Still, even when bidders are prequalified, there will be occasions when the disqualification of the low bidder is necessary. The rules which govern disqualification vary a good deal. Moreover, in some states the disqualification of a bidder is rather a formal matter, while in other states it quite definitely lacks this dignity. More uniform provisions both as to the causes for which bidders are to be disqualified and as to the manner of doing so would seem to be worthy of consideration.

**Delay in Awarding Contract**—After the low bidder has been determined on the basis of the proposals submitted, a contract must be executed. Ordinarily, the award is made promptly and, having been made, a contract is executed within a reasonable period, after which the contractor is directed to proceed. However, when unexpected conditions occur and the state finds it impossible to award within a reasonable period, very perplexing questions may arise. In some states, for instance, the specifications fail to indicate any period within which the proposal expires. This places the contractor under the necessity of accepting a contract when it is offered even though it may not be offered for several months after the proposal was entered.

It would seem to be reasonable to assume that contractors would prefer to have a limit set on the time within which their proposals will remain in effect. There are a good many reasons for this, of which perhaps the most obvious is that if the work is not awarded within a reasonable time after the proposal is submitted, the cost of performing the work it covers may be considerably altered.

Changes in the cost at which the work can be performed are most likely to result from the fact that the delay in awarding the contract has extended the construction period into the winter or has required that the contract be carried over into another construction season. Economic conditions sometimes change so rapidly as considerably to affect the cost at which materials can be secured. Labor conditions change. There are many other reasons which suggest that the period during which a proposal is binding on the contractor should be definitely limited.

**The Contract Period**—This matter is closely associated with the contract period, that is the period during which the work is to be performed. The writer recently had occasion to give rather serious consideration to this matter by reason of the fact that a contract had been brought to his attention in which neither the terms of the proposal nor of the specifications limited the period within which the contractor could be required to accept the work. The advertisement had contained a provision that work must be completed on or before a fixed date, say October 15. Bids had been opened about the first of July. If the award had been made promptly the contractor would have had approximately four months within which to do this work. Actually, the award was made about the middle of September. The contractor signed the contract as presented and without protesting it and without asking for an alteration of the completion date. Legally, he had agreed to complete this project in some 30 days! And, legally, he was properly responsible for liquidated damages for failure to complete within that time.

But this case is not mentioned because of its legal aspects, though they are interesting, but because it illustrates several points in the general provisions that warrant special thought. One of these is that, unless the general provisions of a contract include a clause which provides for automatically extending the contract period to compensate for delays that may occur in making the award, there is no basis for a claim for an adjustment of the contract period, when the circumstances are such as have been outlined above.

Another matter is that often, as in this particular case, the contractor has based his bid on performing the work during the very best part of the construction season. In such cases a delay in making the award may not only throw the work into a period of the year when general weather conditions are adverse but may make it necessary to carry the work over into the next year. Both of these circumstances are all but certain materially to affect the total cost at which the contract can be executed.

Finally, it is worthy of note that, for a small contractor—the man who usually handles one job at a time—never more than a couple—a delay of this sort may be doubly distressing. He can neither get the job nor can he get rid of it, so that he can get another. Out of work during the best season of the year and then forced to work at little or no profit—perhaps at loss—during the rest of the year, his situation leaves much to be desired.

It has seemed wise to go into this matter at some length because there is no obvious solution of the various problems which are involved. It is not difficult to limit the period within which contractors are responsible for the



acceptance of awards. But the situation is not quite as simple as this because, on the one hand, a great many of these delays are of such minor consequence contractors would rather take the work in spite of them, than to have it readvertised. Also, it is no more than natural that it will often appear to awarding authorities to be quite undesirable to readvertise work on which satisfactory bids have been secured. This is, of course, due to the fact that the greater the certainty that the delay has made the work appear less attractive, the less desirable readvertising it is likely to appear. It is not always easy satisfactorily to explain to the public why a good bid was rejected and, later, one not quite so good was accepted.

It is the personal opinion of the writer that the most practical solution of this problem is, first, definitely to indicate that his proposal is binding on the low bidder only during a specific and a sharply limited period—usually from 15 to 30 days; second, to provide for a contract period of a definitely indicated number of calendar days, this period to start from the date the notice to proceed with the work is received by the contractor; and, third, specifically to state in the specifications that no prejudice will be involved in any refusal by a contractor to accept a contract that is offered to him after the period in which his proposal is binding has expired and that no alteration of the contract period will be made as a result of any changed conditions which may result from the delayed award of the contract. This places the contractor on definite notice as to exactly what conditions will prevail in the event the delayed award is accepted and should avoid most of the difficulties which now, on some occasions, arise.

**Extensions of Contract Time**—Another matter which is of general interest to contractors is found in these provisions which deal with extensions of time. These vary a good deal from state to state. As a rule the contract period is automatically and correspondingly extended whenever the amount of the work is increased. This is perhaps as satisfactory a provision as can readily be drawn to cover this matter. It is, however, assumed that contractors will uniformly recognize the fact that, after all, this is a very arbitrary provision. For instance, the extra work may be of such a nature that performing it does not at all affect the period required for executing the contract as a whole. In such cases there is no really valid reason for giving any extension at all. On the other hand, the nature of the extra work may be such that work on the project as a whole must be delayed until the extra work has been performed. In such cases the justifiable extension of the contract period is the period reasonably required to perform the extra work which may be out of all proportion to the relative cost of this extra work. Between these extremes all sorts of variations are encountered. That the present customary provision is arbitrary and sometimes oppressive cannot be questioned. However, its correction is not a simple matter. Perhaps some of you may have a suggestion.

**Reasons for Extension of Contract Time**—Where contracts are drawn for execution by a given date or within a given number of calendar days, adverse weather is not, as a rule, a cause for an extension of time, but many contracts contain a provision that unusually adverse weather is. Provisions of this sort generate a good many divergences of opinion as to whether the weather has been sufficiently bad to warrant an extension of time.

The general adoption of the practice of allowing a certain number of weather working days within which to complete contracts has been widely urged as a means of avoiding differences of opinion concerning extensions of contract time on account of adverse weather conditions.

In fact, many states now use weather working days as a basis for determining the contract period. This system has its advantages but it is not without very definite disadvantages. This arises from the fact that, while the weather may be perfectly satisfactory so far as the performance of a certain part of a contractor's work is concerned, it may not be satisfactory for the execution of other parts of it or for operating the job as a whole. In some places this has led to a modification of the weather working day basis of determining contract time by the inclusion in it of a provision under which the determination as to whether a weather working day shall be charged depends on whether the contractor's then major operations can be conducted on that day. Under this system the contractor whose contract covers, let us say, both grading work and paving work might, for instance, work on his culverts—culvert construction usually being an incidental part of grading operations—without being charged time, if on the day in question it was not reasonably possible for him to proceed with his regular grading work. Similarly, if he has completed his major grading operations and started his paving work, the weather might be such as to permit work on the shoulders and slopes even though no surfacing could properly be laid down.

It should be remarked that all of the plans which are used for the determination of the contract period and the additions thereto which are proper in view of weather conditions, are an effort on the part of the state officials to deal reasonably with the problems this matter presents—that is, to develop rules under which contractors are treated fairly—while at the same time the evident interests of the state are reasonably protected. The number of these plans that have been adopted and have secured some vogue serves to emphasize the complexity of the problems which an effort is being made to solve. The engineers who are studying these problems would appreciate the suggestions of contractors and contractors' organizations.

**Shut-Downs for Causes Beyond Contractor's Control**—Another major cause of requests for extensions of the contract is found in shut-downs for causes that are beyond the control of the contractors. These include a considerable number of quite unrelated matters such as failures to provide right of way, unexpected ground or other conditions that require changes in plans, labor difficulties, etc. It is a generally accepted rule that if the state finds it necessary to halt construction, an extension of time equal to the period during which the work was shut down is warranted though it may be remarked that often specifications are not quite as clear on this point as could be desired. Ordinarily it is assumed that such extensions of time are fair and reasonable.

They are, perhaps, all that can be done to adjust these matters but it should, nevertheless, be more generally appreciated that shut-downs disorganize a contractor's work and that if they are of extended duration they are apt to throw part of it into the season of the year when construction costs are increased by adverse weather conditions. It will, of course, be perfectly clear that it is not altogether possible to avoid shut-downs of this sort. Contractors understand this and customarily accept such shut-downs as one of the unavoidable risks of highway construction. On the other hand, every state highway department endeavors to avoid the conditions which create them. At the same time it remains a fact that the more active opposition of contractors' organizations to basing plans on inadequate field examinations of the site of the work and to advertising work before all the right of way has been secured might prove of assistance. It is here



that most of these shut-downs originate, so it is here that attention may reasonably be given to their more complete avoidance. Their avoidance is of no inconsiderable importance to contractors for, while it is beyond any question that corresponding extensions of time do not compensate contractors for the expense they involve, the determination of what this expense really has been is so difficult that adjustments would not be easy even if no legal problems were involved. As before suggested, the solution of this problem seems to lie in the encouragement of an avoidance of those practices which cause these shut-downs.

**Shut-Down Orders**—Shut-down orders which are the result of improper acts of the contractor or his employees and those given because the weather or some other condition has rendered it improper to proceed with the work, should not and do not generate extensions of time. It has been the writer's observation that contractors do not always sharply discriminate between a shut-down order that is given because, for instance, the subgrade is too wet to justify working on it, and one given because the state finds a change of plans necessary and must stop the work until the change has been made. Presumably the specifications are not quite as clear as they should be as to this matter.

Most specifications require that extensions of time shall be requested in writing and granted in writing. This, of course, is done, among other things, to provide a clear record of the agreement. Usually it also is required that the request for such an extension is to be made at the time the circumstance warranting the request occurs. Two comments seem appropriate—that some of the provisions that deal with this matter are not as clear as could be desired and that there is a widespread disregard of the requirements that requests for extensions of time shall be made in writing—a still wider disregard of the customary requirement that these requests shall be made at the time the conditions warranting an extension occur.

The desirability of settling matters of this sort at a time when the facts are known to, or can be readily ascertained by, those who must act on the request is apparent. There have been a good many references to points at which the general provisions require further study with a view toward some revision. Here the thought is that probably the real need is for a more exact observance of the letter of the specifications as they now stand.

**The Clean-Up**—I will mention only one other matter—the clean-up. Particularly in the case of jobs that run into the winter, it often happens that pretty much everything but the final clean-up is finished before severe weather finally stops operations. As a rule, work in this condition is opened to traffic, the contractor being expected to complete it as nearly as possible in the spring. Admitting—and I do not believe that this will be seriously questioned by any one—that the establishment of a completion date in a contract has two principal purposes—first, to establish a definite relationship as between the contractors' responsibility to provide the indicated improvement and the public's desire to have it and to use it, and, second, to establish some limit on the expense to which the state can be put on account of engineering and related expenses which are an incident to construction and assuming that the public interest in having a structure is at least largely served when it takes over this structure and puts it to public use, after which the need for further engineering expense—principally inspection—is sharply reduced, it will doubtless seem to some of you that there is warrant for further consideration as to whether it is altogether reasonable and proper that liquidated damages

remain collectible at the full amount after a project is opened for use by the public. There is a good deal to be said on both sides of this matter, not the least important aspect of it being that, while delay in completing work often inconveniences the public, opening it to traffic certainly adds to the cost at which that work which remains to be done can be performed.

These are but a few of the matters with which the general provisions deal, on which a little study may serve to suggest a vital contractor interest and the thought that more or less extensive modification would be worthy of serious consideration. You have noted that in what has been said there has been little expression of opinion. That has been avoided because the objective has not been to present a point of view but to encourage you to present yours. May I therefore say again that unusual interest attaches to these matters at this time because of the consideration that is being given to the preparation of Standard Specifications by the American Association of State Highway Officials. For this reason, may I urge again that your views may be presented. May I also again assure you that they are most sincerely desired and that they will be most carefully considered.

**Acknowledgment**—The foregoing is a paper presented Jan. 13 before the annual convention of the Kansas Contractors Association, Associated General Contractors, Highway Chapter.

## Correction of an Error

### SOIL STABILIZATION SHORT COURSE

In order that credit may be placed where credit is due the following explanation should be read in full:

1. In the May issue of this publication a "by-line" was omitted from the heading of the Soil Stabilization article. Along with the writer's name should have appeared the following:

and

**C. A. Hogentogler, Jr.\***

*George Washington University*

2. The writer used the Bureau of Public Roads exhibit at the last Road Show and A. R. B. A. convention at Cleveland as the basis of the series of articles. Explanatory paragraphs were inserted where thought desirable. In some cases the writer did not feel qualified to introduce explanatory matter. This was particularly true of the last part of the May instalment.

3. All of the first part of the May instalment was the original work of C. A. Hogentogler, Jr. To him belongs the credit for the discussion on shear and internal friction. His name was erroneously omitted from the heading. We are sorry this error occurred and hope that all who read the article will also read this explanation and write Mr. Hogentogler's name in on the printed pages.

Signed—

V. J. BROWN,  
Publishing Director.

\*Research Associated Soil Mechanics, George Washington University, Department of Civil Engineering, Frank A. Hitchcock, Executive Officer.

**WORLD PRODUCTION OF MOTOR VEHICLES.** The total production in 1937 of passenger cars, trucks and busses of the plants of the world was 6,352,525, an increase of 9.5 per cent of the previous. Of this world total, 75.7 per cent was produced in the United States.

# ESTIMATION OF POPULATION GROWTH

## *Use of Probability Scale for Its Graphical Measurement*

By WILLIAM WREN HAY

ENGINEERS are frequently required to estimate future demands for public services or for raw materials, both of which depend a great deal on estimates of future population. Expenditures for utility services in particular, under public or private ownership, depend a great deal on reliable estimates of the population to be served. Provisions for such services did not appear excessive while the population was still increasing but the prudence of many public and private utility programs has been questioned since population growth failed to develop as expected. A method of analysis that produces national forecasts of the probable population or demand will be analyzed and examples of its practical application will be illustrated.

Briefly, the method is useful to determine trend lines when the data under consideration seem to develop direction with chance variations. In a free, comparatively unrestricted economic system like ours has been, the behavior of large numbers of the population is predictable in terms of probability trends while the behavior of economic phenomena like the consumption of goods or the use of services is frequently similar to the growth of population. The fluctuations of such phenomena, when treated graphically, often delineate a trend over a period of years.

The graphical determination of trend lines may be much simplified when the data can be plotted on a scale which would develop straight line trends. Data increasing by equal increments will plot a straight line on arithmetic scales, that which has equal percentage increases will develop a straight line on ratio (semi-log) scales, while a hyperbolic scale is useful to straighten data of a special kind. The cumulative probability curve can be straightened out on probability paper<sup>1</sup>,

<sup>1</sup>Invented by Allen Hazen cf. Trans. A. S. C. E., Vol. 77 (1914), p. 1529 et seq. Sold by Codex Book Company, Inc., Norwood, Mass.

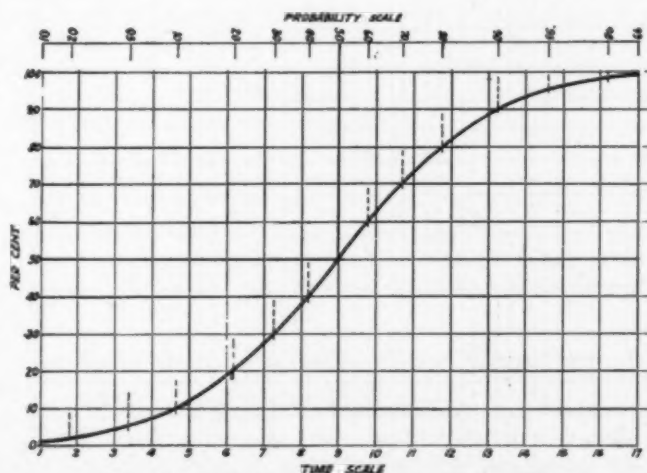


Fig. 1—Development of a Probability Scale.

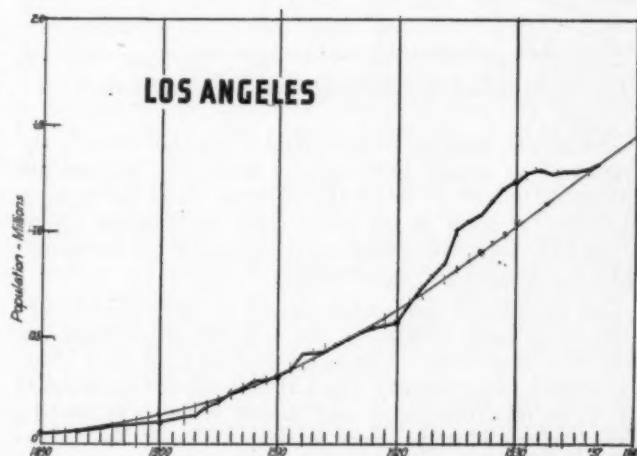


Fig. 2—Population of Los Angeles, Calif.—Probable Trend.

which is a convenient device worthy of more widespread use. Its original use, for the study of normal distribution, is well known to engineers and perhaps the excuse for its comparative obscurity, a quarter-century after its invention, is the absence of any description of its derivation. The application of the integral or cumulative probability curve to economic data was first proposed by the late Malcolm C. Rorty in 1930.

It has long been observed that economic data behaves very much like natural phenomena and it has been the fad to fit economic data to curves derived from biological phenomena. The complete failure of such statistical skeletons to correctly forecast current trends ought to discredit their use. On the other hand, the measurement of economic phenomena like the growth of population or the consumption of foodstuffs is materially simplified by the use of probability trends and the results are both rational and dependable.

### Analysis of Probability Trends

The simplest way to describe probability trends and the derivation of the probability scale would be to consider a power boat starting from shore and proceeding over a measured course at the end of which it comes to anchor. Physically, the vessel would accelerate up to a certain distance, after which it would have to slacken speed in order to stop. Throughout its course it would be subjected to the influences of winds and currents. The resolution of time (x) and distance (y) would plot as an ogive (Fig. 1), which slopes gently upward, then rapidly, to fall over to a gentle slope again. This is an ideal curve; the actual curve would fluctuate as wind and tide retarded or assisted the boat's passage. Furthermore, the course might be easily kept during acceleration but as the speed fell off it would be more difficult for the vessel to resist the tides and weather.



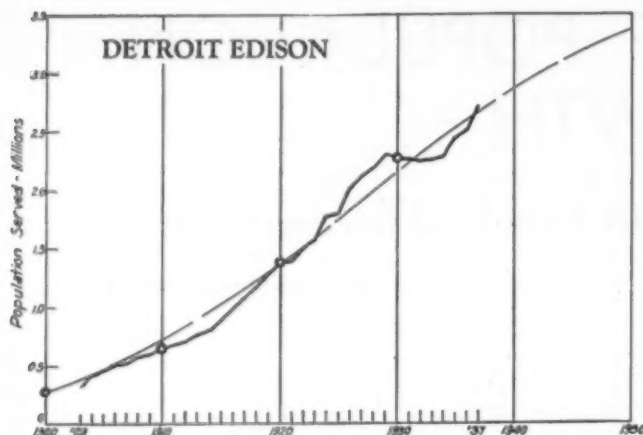


Fig. 3—Estimated Population Served by Detroit Edison Co.

The initial impulse would come from the vessel's engines and so would acceleration; while the engines are full speed ahead it would be easy to keep the course. However, as soon as the drive from the engines begins to slacken, then the influence of physical forces would make for a more and more erratic course.

The growth of population or of demand (consumption)<sup>2</sup> is entirely similar to the physical experience we have just described. The early growth is at first slow, it increases progressively for a time until the increments get to be relatively large and nearly equal. When the period of rapid expansion is near its end, the increments commence to diminish until finally growth is slow with years of losses as well as gains. During the period of vigorous growth, internal factors predominate; towards the end of growth, external factors have the greatest influence. The growth of population and the development of consumption are alike self-stimulating until outside influences begin to be effective.

The curve (Fig. 1) that we have just described is the integral probability curve. It is similar to the time trend of the vessel's course and may also be considered to be the probable trend on a time scale of economic phenomena. In order to construct the probability scale lay off the time required for each increment of distance, thus developing a scale which contracts symmetrically from the ends toward the middle. Using this new scale<sup>2</sup> (graduated from 1 to 99) as the vertical scale, it is apparent that, on the same time scale (x-axis), the data would lie on a straight line. The function of probability paper is to straighten out data which has direction on a time scale and, by extending the straight line, we can forecast the position of the trend for several years in advance.

From now on, we shall refer to the probability scale as fixed whereas the time scale varies between groups of population and between areas of consumption. For instance, it might require more than a century for the population of New York to reach the same stage of growth that a "boom" city might reach in half that period; or, the time taken by the cotton goods industry to reach saturation was a great deal longer than the time it took to put a radio set in nearly every household. That is, the skew of the probability trend varies.

In order to convert data of various skew so that they will straighten out on probability paper, multiply by a coefficient; if the resultant curve is concave upward, the coefficient is too large; if concave downward, it is too small.

<sup>2</sup>The time probability curve is infinite (approaches horizontal limits 0, 100) so that the actual length of the scale shown is from 1 to 99.

When dealing with economic data, it is necessary to fit the early years, when variations are usually small, because the early years of growth of either population or consumption are the years that determine the true shape of the trend (skew). Furthermore, after more than one-half the full development has taken place, the trend is likely to lose its symmetry and revert to a straight line trend of small upward slope. This is because the external factors have become predominant.

The importance of determining correct trends is amply justified when we consider the biased estimates made of future population in the territory to be served with power supply from Boulder Dam. The composite estimate was based on continuation of abnormal growth like that of Los Angeles (Fig. 2) which was the largest metropolitan district in the area. In the decade 1920-1929 the population of Los Angeles increased as much as it might have in 16 or 17 years of normal growth and everything was predicated on that sort of expansion. Our own study, made in 1933, plainly indicates that the *probable* future population did not warrant the assumption. The increments added since to this population have become quite small and the total is approaching the indicated trend.

Successful estimates of future population depend largely upon continuous annual figures and upon the method of handling them. The Detroit Edison Company publishes in its annual reports an estimate of the population served by it, and this series will be used for the purpose of making an estimate and to display the method of fitting a probability trend.

### An Estimate of Population Growth

The territory served by the Detroit Edison Company is a natural economic area. Expansion of utility service into new territory was quite rapid and, at the same time, population growth was greatly stimulated by the development of the automotive industry. This combination of circumstances tended to create an illusion that the growth from 1910 to 1930 would continue (Fig. 3). The annual data were plotted on probability paper (Fig. 4) so that it would "straighten out," i.e., it would

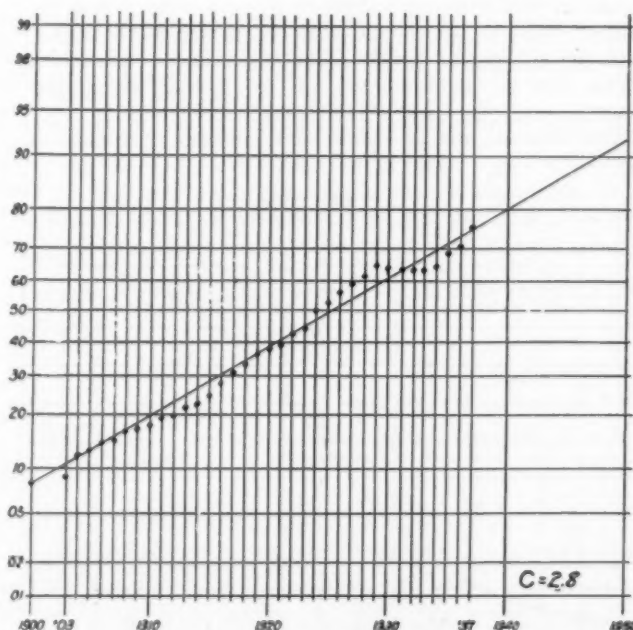


Fig. 4—Straight Line Trend on Probability Paper Fitted to Population Served by the Detroit Edison Co.



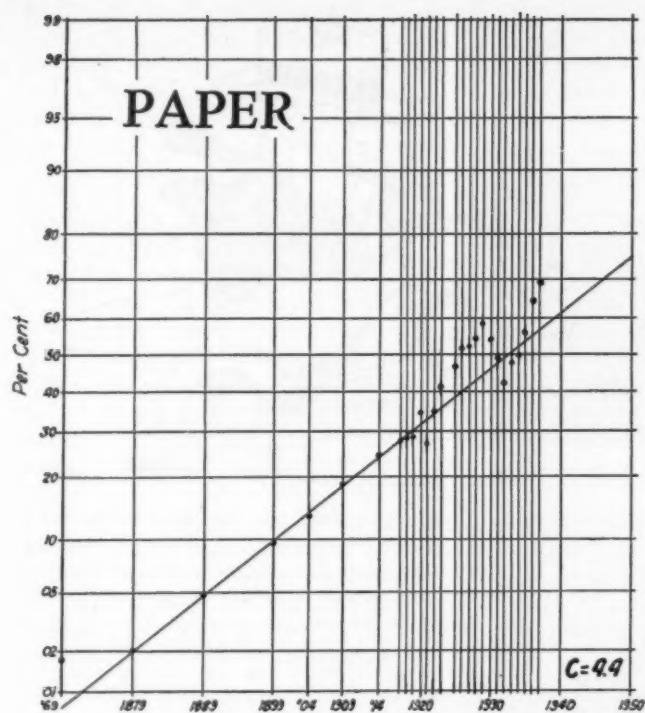


Fig. 5—Straight Line Trend Fitted to Economic Data.

fluctuate about a straight line trend that could be projected to provide an estimate for 1940 and for 1950.

Referring to Fig. 4, a coefficient 2.8 (actually  $2.8 \times 10^{-7}$ ) is selected, by trial and error, to convert the figures of population to per cent, as that is the probability scale. This procedure straightens out the data so that the straight line trend can be interpolated, making it parallel to the low points of the series. The line was projected and readings taken at 1940 and 1950.

The straight line on probability paper is converted back to figures of population (divide by the coefficient 2.8) and these may be interpolated as the probable trend of population (Fig. 3). The data are seen to fluctuate on the trend.

This procedure is simple enough although there are some points that need to be stressed. In the light of subsequent events, it is now apparent that it was a fallacy to take (Fig. 2) the expansion from 1920 to 1930 as being the *trend* of population for Los Angeles. Likewise, the growth of the population served by The Detroit Edison Company was not measured by the sustained expansion from 1912 to 1929, nor would anyone be justified in assuming that it would continue to grow as it has since 1934. The *direction* of these growth curves is that established by the probability trend and the tendency of the population to fluctuate about its trend is a sort of measure of its stability.

The random growth of both these "boom" cities is characteristic of the behavior of comparatively small numbers. Large numbers, like the population of the whole nation, scarcely vary at all from their trends and, by the same token, the fewer the population, the more it would fluctuate and the more difficult it is to fit reliable trend lines.

### An Estimate of Probable Paper Consumption by 1950

The consumption of paper in this country is influenced a great deal by economic and psychological factors, consequently it varies greatly from time to time.

Newsprint and paperboard account for more than one-half of our annual use, and both of these products are sensitive to current business conditions, the one because of advertising, the other because of the movement of consumers' goods. Our annual consumption of newsprint is increasing very slowly and appears to be slackening, whereas our annual consumption of paperboard (used in packaging and for shipping containers) is expanding. No other papers are as important.

A short while ago, a monumental study of a sector of the pulp and paper industry presented an estimate of the consumption of all kinds of paper in the United States by 1950. The estimate of 22,600,000 tons was of a magnitude to attract attention, since the largest consumption estimated for a single year has been 13,350,000 tons, in 1929. The published estimate was based on the assumption that per capita consumption would continue to increase in the manner it had been and that the population of the United States would be 151,487,000 by 1950.

In the first place, such an estimate of population by 1950 is now recognized generally as being too high, by perhaps 10 millions; in the second place, per capita consumption of paper is approaching saturation. On the basis of about 141 million population by 1950, the estimated 22,600,000 tons would be reduced to about 21 million tons. Even this appears to be high, for it would call for accelerated consumption.

An estimate of our probable use of paper by 1950 has been made by straightening out the available data (taken from the report in question) on probability paper (Fig. 5). In this case, a coefficient 4.4 was used. The earliest period (Census of 1870) can be neglected because the manufacture of wood pulp did not get under way until later. The direction (slope) of this straight line is determined (a) by straightening out the early years and (b) by keeping it parallel to the low years, 1921 and 1932.

The straight line trend projected to 1950 and converted to tons gives an estimated 17,300,000 tons by 1950. Actual use at that time may be lower or much higher because annual consumption fluctuates above and below the trend. However, the direction of consumption of all paper products will probably follow this trend, unless some unforeseen factor (press censorship) should intervene.

### School for Highway Superintendents to Be Held at Cornell

A 4-day training school for town highway superintendents, first of its kind in New York state, will be held at Cornell University, Ithaca, N. Y., June 22 to 25 inclusive. The school is sponsored jointly by the Town and County Officers' Training School of New York State, the State Association of Superintendents of Town Highways, the State College of Agriculture, and the College of Engineering. Technical experts from both colleges, the United States Bureau of Public Roads, the State Division of Highways, and others will be on the program. A smoker, a banquet, and a town-board meeting are on the program for evening sessions. Mornings are devoted to lectures and a daily discussion period; midday to films; and afternoons to demonstrations, round-table discussion, and tours. About 1,000 are expected to attend. Similar schools have been held in the past for justices of the peace and other town and county officers.

# OBSERVATIONS BY THE WAY

By  
**A. PUDDLE JUMPER**



How the little town of Whitesboro, Texas, on U. S. 82, beautified an ugly undercut. Flowers of several varieties line both sides of the roadway. A little park on the town side, planted with flowers and beau-



tified leaves a pleasing memory with the traveler near Whitesboro.

Congratulations folks. May thousands of other cities and towns follow your example.

How Contractor Guy H. James was pouring the handrail on Oklahoma's biggest bridge. I took the



shot on my way south. The bridge crosses the Canadian River between Purcell and Lexington.

Dragline building road grade to Texas monument commemorating the battle of San Jacinto which was the decisive battle that won Texas her freedom from Mexico. The monu-



ment is higher than the Washington monument in Washington, D. C., so Texans tell me. The Lone Star on top is 35 ft. wide from tip to tip.

Have you ever noticed how some of your bench marks change elevation—particularly in clay soils? Look into it.

It seems to me like state and county highway departments would welcome the opportunity to form a cooperative project with the U. S. geodetic survey crowd for triangulation mapping of their jurisdictions.

In a short speech I made the other day I made the statement that modern traffic moves at speeds that are in the range of 55 to 65 miles an hour. After the talk was over a gentleman in the audience who is on a governor's safety committee asked me if I thought present day speeds were too high.

I said, "No, they're not high enough."

There was no reply to that. Later I found out that this man exceeded the state speed limit for the entire distance from his home to the conference. He told me so himself.

Talking about mixing pavement concrete, you should have seen this Rex paver romp down the fine grade on Connecticut's Merritt Parkway. Note the extra engine on the Jaeger finisher. It is a motor-generator outfit that furnishes electric energy for an electric vibrator. All concrete



along the forms is vibrated independent of the finisher. Mr. Beecher, the project engineer, says that this 34-E dual drum paver causes much lower bid prices for concrete. The New Haven Road Construction Company are the contractors.



¶ Down in Texas a queer motor vehicle license plate racket developed last year, but it is getting under control now. The state law requires motor vehicles to purchase licenses in the county. Some smart equipment dealers conceived the idea that they could sell more equipment to smaller counties by influencing fleet truck owners to register in the small county. They would take the county script in payment for equipment sold and then cash the script against the moneys collected from out-of-county motor vehicle registrations. The result of the racket was that the state highway department was getting about \$3,000,000 less income than was expected. You see, Texas counties are allowed to retain the first \$50,000 collected. So these sharp equipment men would get motor vehicles to register in a nearby county where the usual income was only about \$20,000 or \$25,000. Then by taking script for the balance up to \$50,000 they could sell the counties considerable new equipment. The little trick was discovered, alas, and now a few motor vehicle owners are shaking in their shoes. They are afraid the Highway Patrol will catch them and make them buy new plates.

It so happens that the counties participating did not have any semblance of a competent highway engineering organization. The bubble has been burst. It was a good racket, though, while it lasted.



¶ Herewith a view of the old bridge to be replaced by the most expensive bridge built (now under construction) in the State of Oklahoma. The new bridge is 3,750 ft. long between Lexington and Purcell, Oklahoma, across the Canadian River. The approaches will cost \$118,000 and the structure \$654,000.

¶ In driving the streets of New York City, if one studies the actions of other drivers and particularly the taxi drivers, one cannot help but be impressed with the apparently inexhaustible good nature of the average Irish New York traffic cop.

¶ You've often heard the remark, "Remember the Alamo," and probably wondered as much as I did just what it meant. Here's a picture of it. It's the cradle of liberty for



Texas (located in San Antonio) and the place where many Texans were slaughtered at the start of the Mexican War. "Remember the Alamo" became a battle cry.

¶ Old man Obsolescence has almost caught up with U. S. Route 24 in west-central Illinois, as witnessed by a dozen or more curves of the vintage of the 1920's, all within a few miles distance. I wanted to pace out the radii, but having on my Sunday shoes and best pants, was discouraged by the muddy fields and barbed wire. I suspect, however, that none of them exceeded 300 ft. Good superelevation takes a little of the curve off, but does not make them right for a route like U. S. 24 carrying a heavy through bus traffic.

¶ One fellow said there's only one thing he gets more kick out of than listening to two Texans talk about Texas and that is two Californians talking about California. Why? You ask. Well—the Texans laugh to each other about the grossly magnified statements while the Californians are in dead earnest.

¶ The east, or Lexington, Oklahoma, approach to the Canadian River bridge is an hydraulic fill. Outside of Florida, this is the first time



I ever saw a bridge fill made by pumping.

¶ What's a stranger going to do in Oklahoma City in a snowstorm, to find a street address?

¶ Impressions I gained in a short trip down Kings Highway No. 2 in Ontario, Canada, could be listed, thus:

1. The flimsy appearing cable highway guards.
2. The excellent, high grade engineering used on the streets of Toronto.
3. The excellent engineering on the new dual lane concrete road on No. 2 east of Toronto, as well as the fine black top road west.
4. The smoothly surfaced streets of Toronto.
5. The terribly pot-holed black top road about 2 hours east of Toronto.
6. The well marked highway and caution signing.
7. Like America, the apologies for slippery paving.
8. And best of all, the reasonable speed signs, erected when entering towns and cities, viz., "Speed 30 Miles per Hour, Drive Carefully." Contrast that with our American city speed signs, viz., "Speed Limit 10 Miles per Hour, Strictly Enforced."
9. The freedom of high speed maintenance crews.
10. ReflectORIZED signs.
11. Large signs at important junctions giving town names, mileages, and directions from there.
12. Unsatisfactory patching by
13. Numerous grade crossings.
14. The congestion of No. 2 about one hour east of Toronto.
15. Congeniality of the people—"Cheerio."



¶ The first American road builder.

There are few more than 9,000 miles of state maintained roads on the primary Kentucky system. The number of miles jumped more than 1,000 after Governor Chandler took office. Each county now has the services of at least one maintenance crew.

# American Road

WASHINGTON, D. C.

## UPHAM, MacDONALD, VAN WAGONER SAIL

### Down the Road

By CHARLES M. UPHAM

Engineer-Director,  
American Road Builders' Association, Washington, D. C.

#### GOOD ROADS REDUCE LOGGING COSTS

"Logs," the veteran timberman will tell you, "are where you find them!" But, after you find them, there's still the problem of getting the logs out of the woods to the mill. The question of transportation, then, is one of major importance to profitable logging operations. Cheap logs are those that can be swiftly and economically brought out of the woods to the mill. Cheap logs are, naturally, those most desired by the logger and many a veteran operator has become convinced that rolling them out on pneumatic tires has dragging them out by antiquated methods beat a mile. Pneumatic tires suggest a truck, a truck must travel a road and there you have my story.

Ten years ago roads first began playing a prominent part in the American logging industry's exciting drama. Slowly but surely, during the past decade, loggers everywhere have realized the tremendous savings that can be obtained by transporting logs by truck instead of by rail. The depression is largely responsible for this new logging method. The discovery that the railroad is not the only solution to the transportation problem of the man with timber was made by men thrown out of work by the slump in the lumber market.

These men had an intense desire to remain self-sustaining and it was not long before they learned that they could buy small tracts of timber near good roads and haul it by truck to small mills where it could be sold at a nice profit. Soon, however, the supply of lumber adjacent to the highway was exhausted. To be able to continue to haul their product by truck, the energy and resourcefulness of these loggers led them to construct new roads back from the primary and secondary highways where no roads existed before to reach other stands of timber. They built dirt roads for summer use and all-weather roads for use throughout the year. They found the construction cost of one of these roads to be one-tenth the expense of a railroad

spur. In this way, hundreds of thousands of feet of standing timber has been milled that might never have been logged under the old system with the limitations of the logging equipment available ten years ago. So-called isolated timber tracts that were left behind in logging operations of the past because they could not be easily and economically reached are the locations of some of the most profitable operations of the truck logger of today.

Soon after Congress passed legislation in 1916 authorizing federal aid for highways, there arose a great demand throughout the rural sections of our country for the earmarking of specific sums of all funds appropriated for highways for the construction and maintenance of secondary, or feeder-type roads that are absolutely necessary to the farmer in getting his produce to market. As a result, the expression "farm-to-market road" has come to be as much a part of the average ruralite's vocabulary as "court-house square." Incidentally, many of the roads built for logging have become valuable links in the present farm-to-market system and provide the farmers who settled the cleared tracts in the wake of the loggers with the necessary access to the main highways.

With logging operations penetrating farther back into the denser and hitherto inaccessible stands of timber, with sawmills constantly demanding "more logs," with loggers concentrating on the delivery of "cheap logs" to these mills by the use of steadily growing fleets of trucks to save the unnecessary expense of spur railroad track construction, I believe the next few years will witness a forceful demand for a system of "forest-to-mill" roads. A direct and interesting result of this procedure will be the saving enjoyed by the average businessman-consumer who builds his house of wood, furnishes it with wooden furniture, sits all day on a wooden swivel chair and labors over a wooden desk to pay for it and a thousand other articles the manufacture of which depends on wood.

#### UPHAM, MAC DONALD, VAN WAGONER SAIL FOR INTERNATIONAL ROAD CONGRESS

Charles M. Upham, engineer-director of the American Road Builders' Association; Thomas H. MacDonald, chief of the United States Bureau of Public Roads, and Murray D. Van Wagoner, Michigan state highway commissioner and newly installed A. R. B. A. president, who have been appointed by President Roosevelt as delegates to represent the United States government on the International Commission of the permanent International Association of Road Congresses, at The Hague, under the royal patronage of Her Majesty the Queen of The Netherlands, sailed from New York, Wednesday, June 1, aboard the S. S. Washington. Mr. Upham will visit in France and England before going to The Hague and he will go to Berlin after the Congress to inspect the German super-highway system.

#### HELM WINS A. R. B. A. TROPHY

Joseph S. Helm, president of the Asphalt Institute, New York City, was the winner of the annual golf tournament of the American Road Builders' Association at the Congressional Coun-



A.R.B.A. Championship Golf Trophy won by Joseph S. Helm, president, The Asphalt Institute, New York City. Story on opposite page.



# Builders' Review

JUNE, 1938

## FOR INTERNATIONAL ROAD CONGRESS

### With Our State Groups

#### MASSACHUSETTS

The May 12 quarterly meeting of the Massachusetts Highway Association was attended by more than 200 members. An interesting feature of the meeting was a half-day tour of the plants of several of the association's manufacturer members. Arthur H. Woodward, Springfield deputy superintendent of streets, recently completed fifty years in that city's employ. To celebrate the occasion he was given a testimonial dinner which was attended by 500 city officials, employees of the street department and other friends and fellow workers.

#### MICHIGAN

Twenty-three associations took part in the Michigan Good Roads Federation banquet, held at Grand Rapids on April 28. Among the 2,000 in attendance were representatives from Association of Southern Michigan Roads Commissions, Automobile Club of Michigan, Detroit Industrial Safety Council, Earle Memorial Super-Highway Association, East Michigan Tourist Association, Grand Rapids Safety Council, Michigan Association of Road Commissioners and Engineers, Michigan Good Roads Federation, Michigan Hotel Association, Michigan Motor Bus Association, Michigan Petroleum Industries Committee, Michigan Road Builders' Association, Michigan State Farm Bureau, Michigan State Grange, Michigan State Highway Department, Michigan Trucking Association, Northern Michigan Road Commissioners' Association, Pontiac Citizens' Traffic Safety Council, Southeastern Michigan Tourist and Publicity Bureau, Taft Memorial Highway Association, Upper Peninsula Development Bureau, Upper Peninsula Road Builders' Association, West Michigan Tourist and Resort Association, United States Congressmen Wilburn Cartwright of Oklahoma, chairman of the House Roads Committee, and Jesse P. Wolcott of Michigan, member of the same committee; Michigan Governor Frank Murphy, Charles M. Upham, A.R.B.A. engineer-director; Murray D. Van Wagoner, new A.R.B.A. president, and others were program speakers.

#### NEW HAMPSHIRE

The annual Ladies' Day Meeting of the New Hampshire Good Roads Association will be held June 23 and 24 at "The Balsams" eleven miles east of Colebrook, popular New Hampshire mountain summer resort.

#### PENNSYLVANIA

The Associated Pennsylvania Constructors met in annual business session at the Penn-Harris hotel, Harrisburg, April 27. James J. Skelly of Media was unanimously re-elected president of the association as were the other officers that had served with him during the past year.

#### TEXAS

Officers elected by the Texas Good Roads Association at its April meeting in Austin are Lowry Martin, publisher, "Corsicana Daily Sun," Corsicana, president; Oscar Burton, vice-president and general manager, Gulf States Telephone Company, Tyler, 1st vice-president; Joe Leonard, publisher, "Daily Register," Gainesville, 2nd vice-president; Max Starke, mayor, City of Seguin, 3rd vice-president; Franz C. Groos, president, Groos National Bank, San Antonio, secretary - treasurer; Datus E. Proper, San Antonio, executive vice-president; Charles B. Shorter, San Antonio, financial secretary, and Charles E. Simons, Austin, publicity manager.

(Continued from previous page)

try Club in Washington, D. C. on May 11. Mr. Helm's name will be the first engraved on the A.R.B.A. cup as champion of this tournament. The low net score turned in by Mr. Helm also entitled him to the first prize of three hand-made Butchart golf clubs. Since he was the donor of these clubs, however, he requested that they be turned over to Michigan State Highway Commissioner Murray D. Van Wagoner who was installed as president of the A.R.B.A. on May 12.

Among the other winners of the thirty-six prizes donated by manufacturer members of the association were Lion Gardiner, vice-president, Jaeger

Machine Co., Columbus, Ohio; C. H. Lehman, vice-president, Blaw-Knox Co., Pittsburgh, Pa., and C. B. Smythe, vice-president, Thew Shovel Co., Lorain, Ohio. George S. Schlesinger, chief engineer and managing director, National Paving Brick Association, Washington, was chairman of the committee in charge of this tournament.

Prizes for the game were donated by Chester H. Lehman, executive vice-president of the Blaw-Knox Co., Pittsburgh, Pa.; W. E. Miles, sales manager, the Cleveland Tractor Co., Cleveland, Ohio; J. E. Pennybacker, managing director, the Asphalt Institute; M. H. Wright, commercial tire sales, Fisk Tire Co., Inc., Chicopee Falls, Mass.; Paul L. Griffiths, vice-president, Koppers Co., Pittsburgh, Pa.; F. J. Nelson, advertising manager, Macwhyte Co., Kenosha, Wis.; Larry B. West, owner, Simplicity System Co., Chattanooga, Tenn.; C. B. Smythe, vice-president, Thew Shovel Co., Lorain, Ohio; R. C. Byler, advertising manager, SKF Industries, Inc., Philadelphia, Pa.; Fred Zimmerman, sales manager, Broderick and Bascom Rope Co., St. Louis, Mo.; the Cleveland Rock Drill Co., Cleveland, Ohio; J. F. Cast, manufacturing sales manager, Firestone Tire and Rubber Co., Akron, Ohio, and William M. Parrish, industrial sales executive, International Harvester Co. of America, Chicago, Ill.

This tournament and the installation of Commissioner Van Wagoner were features of the annual May meeting of the A.R.B.A., May 11-13. Other officers and directors of the association and its various divisions were also inducted to office at this time and plans for the association's activities for the next twelve months were formulated.

Speakers at the banquet in honor of the retiring president, Colonel Willard T. Chevalier, included Charles M. Upham, A.R.B.A. engineer-director; William P. McDonald, past president of the A.R.B.A.; Commissioner Van Wagoner, Congressman Jesse P. Wolcott of Michigan, Mrs. Wilburn Cartwright, wife of the chairman of the House Roads Committee, and E. W. James, chief of the transport division of the Bureau of Public Roads. Paul B. Reinhold, vice-president for the northeastern district, Pittsburgh, Pa., served as toastmaster.

# SNOW REMOVAL IN 1936-37

**D**URING the winter of 1936-37 the 36 States in the snow belt expended \$17,099,626 in snow removal and ice treatment on 217,243 miles of main highway. In addition to actual removal of snow the States erected 12,040 miles of snow fence to prevent formation of drifts. According to a report by H. A. Radzikowski, Associate Highway Engineer, U. S. Bureau of Public Roads, in the March issue of Public Roads, from which these notes are taken, in each of seven States the mileage of roads cleared of snow exceeded 10,000 miles; and in each of five States the cost of snow removal and ice treatment exceeded \$1,000,000.

The major equipment used in the 1936-37 work was as follows:

	Number
Trucks	13,634
Tractors	1,316
Graders	2,505
Plows for trucks:	
Displacement type	12,784

Rotor type	209
Plows for tractors:	
Displacement type	1,029
Rotor type	107
Power shovels	41

Average snowfall figures for each State, reported by the U. S. Weather Bureau, are shown in Table I. These data are average figures for the entire State, compiled from records at stations located in various parts of the State. The average snowfall during the 1936-37 season was less than that during the previous winter in 25 States and greater in 10 States. In 8 States in the snow area the average snowfall was less than 20 in. during 1936-37, and in 10 States it exceeded 60 in.

Average snowfall figures, however, cannot be accepted as a true index of the extent of the snow removal problem. Snowfall in mountainous regions may greatly exceed the average reported for the State. In one State the snowfall was reported as 469 in. on a mountain pass kept open during the winter season.

TABLE I—SNOW-REMOVAL AND ICE-TREATMENT DATA FOR THE WINTER OF 1936-37

State	Snow removal and ice treatment supervised by—	Comparative average seasonal snowfall from records in different sections of State <sup>1</sup>		Snow-removal equipment <sup>2</sup>							Mileage of snow fence	Mileage of roads cleared of snow	Total cost of snow removal and ice treatment	Remarks	
		1935-36 season	1936-37 season	Plows for trucks		Plows for tractors		Trucks	Tractors	Graders					
				Displacement type	Rotor type	Displacement type	Rotor type								
		Inches	Inches	Number	Number	Number	Number	Number	Number	Number	Miles	Miles	Dollars		
North Atlantic States:															
Connecticut	State	45.5	21.3	343				343			29	2,700	302,900		
Maine	do.	99.3	63.0	286	1	44	1	287	45		184	2,433	372,880		
Massachusetts	do.	45.7	22.0	819		23		851	23		54	1,762	588,541		
New Hampshire	do.	91.8	71.2	234	1	3		242	3		148	2,566	561,094		Chlorides, \$36,656; plowing, \$144,346; sanding \$347,364; and snow fence, \$32,828.
New Jersey	do.	32.0	12.2	450	6	3	4	456	7	102	91	1,572	220,396		2 snow loaders also used.
New York	State and counties.	60.5	59.5	1,499	19	240	17	1,552	224	79	1,167	12,077	1,642,393		\$808,488 expended by counties for snow removal; \$833,905 expended by State for sanding; 56 of 57 counties on State highway system reported.
Pennsylvania		56.4	29.0	1,232	18	83	24	1,250	107	239	1,906	16,729	2,707,555		
Rhode Island	do.	24.7	10.2	110			10	110	10		15	762	58,730		\$12,882 for snow removal; \$45,848 for ice sanding.
Vermont	do.	68.9	63.3	120		5		120	5	3	112	1,759	327,585		
South Atlantic States:															
Delaware	do.	34.1	8.9	130		3	1	116	4	5	23	2,800	14,369		
Maryland	do.	43.2	23.8	249	11	4	3	437	74	45	130	3,985	99,131		
Virginia	do.	33.4	14.1	508	2	74		510	74	44	8	9,225	31,327		Data refer to primary State system.
West Virginia	do.	66.5	27.2	229		14		333	16	34	37	4,565	74,808		Some evergreen trees planted along the roadside for snowdrift control.
North Central States:															
Illinois	do.	28.2	14.0	827	1			827			250	12,638	511,740		
Indiana	do.	25.7	18.4	504	2	4		506	4		11	8,848	156,253		
Iowa	do.	50.9	31.1	663	13	7	3	620	10	280	1,481	8,902	1,107,893		
Kansas	do.	10.8	16.2	167		39		167	39	140	480	7,631	125,316		
Michigan	do.	62.7	38.0	385	6	8	17	445	25		714	9,226	869,044		Some evergreen trees were planted along the roadside for snowdrift control.
Minnesota	do.	57.3	69.0	432	23	22	10	364	5		1,161	11,195	1,603,323		
Missouri	do.	15.1	14.2	270	2	1		500	1	50	244	13,750	310,367		
Nebraska	do.	35.7	26.6	135	4	16		139	50	337	737	8,160	184,067		
North Dakota	do.	39.0	36.3	25	7	1		25	1	25	575	5,000	242,848		
Ohio	do.	41.0	21.1	669	6	10		675	10	35	106	14,000	575,000		
South Dakota	do.	43.9	46.8	47		35	1	47	39	140	281	5,687	610,000		
Wisconsin	do.	61.0	43.8	923	8	228		967	270	406	1,169	10,023	1,118,495		About 8 miles of hedge planted for snowdrift control; 21 power shovels also used.
Western States:															
Arizona	do.	6.6	20.4	24	2	1	5	31	11	30	6	1,000	44,618		
California	do.	( <sup>3</sup> )	( <sup>3</sup> )	130	17	21	1	138	25	60	17	5,263	604,788		Ice-sanding operations covered approximately 1,500 miles of the State highway system.
Colorado	do.	68.2	72.1	234	9	55		305	132	209	68	3,563	152,863		5 power shovels also used.
Idaho	do.	82.1	75.3	167	5	7	3	169	10	30	196	3,557	355,126		2 power shovels also used.
Montana	do.	53.2	51.5	144	11	4		155	4	10	271	4,623	157,000		
Nevada	do.	42.9	32.7	74	8	1	4	82	5		19	2,575	127,900		2 power shovels also used.
New Mexico	do.	26.1	28.0	2		6	1	17		46	3	1,045	29,098		
Oregon	do.	43.3	61.2	223	9		2	232	2	15	40	6,345	307,632		1 power shovel also used.
Utah	do.	64.0	76.7	156		52		164	52	34	135	4,573	400,318		Do.
Washington	do.	54.7	69.9	259	16	3		275	3	20	41	3,471	371,380		3 power shovels also used.
Wyoming	do.	78.4	67.3	135	2	12		157	26	97	131	3,543	123,856		6 power shovels also used.
Total				12,784	200	1,029	107	13,634	1,316	2,505	12,040	217,243	17,099,626		

<sup>1</sup> Snowfall figures compiled from U. S. Weather Bureau records.

<sup>2</sup> The number of displacement plows, rotary plows, etc., listed includes equipment reported as under the control of various States and counties, but does not include equipment owned by numerous other counties for which no data have been submitted or by townships, municipalities, transportation companies, and diverse business agencies.

<sup>3</sup> Not available.



# OUT IN FRONT OF THE TRACTOR

## *An Account of the Development of the Dozer Family and Other Tractor Equipment*

By HUGH H. HONNEN

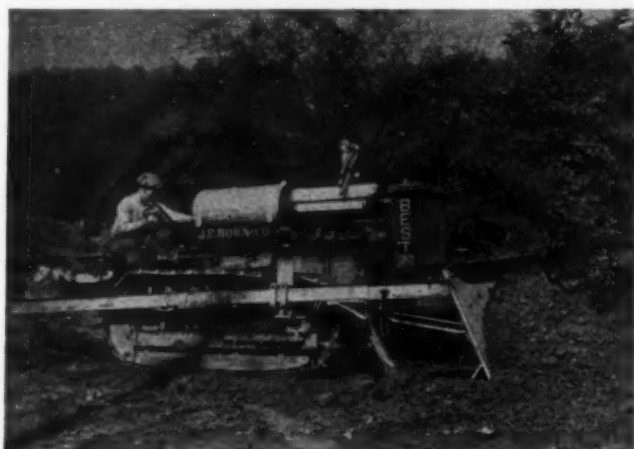
A TRACTOR by itself is rather a useless piece of machinery, but attach some equipment to the front, the rear, or mounted on the tractor—then you have a machine that can do a lot of work. Probably the simplest piece of equipment known for use with a trac-

hauling units similar to the wheel tractors of that time, but the "go anywhere" ability of these new products offered a wide field of usefulness.

### The Bulldozer

One of the first pieces of mounted equipment was an experimental bulldozer built about 1912 by the Killefer Manufacturing Corporation on the West Coast. Previously, contractors and others who needed to level or push dirt used the old team-powered Mormon board. One enterprising contractor hit on the idea of placing the Mormon board ahead of the team with a pole and weight arrangement connected to the doubletrees, somewhat like the pusher team hookup on early day elevating graders. This use of the Mormon board demonstrated the usefulness of also attaching it to the front of a tractor for more horsepower.

The early experimental bulldozer models were rough affairs; the principal of design, however, is practically the same today as it was then, but vastly improved. The



*Tractor and Bulldozer Working Near Pittsburgh in 1926.*

tor is a cable of sufficient length to tie onto something. From this simple beginning we find the line of equipment used with tractors broadening out to bulldozers, snow plows, scrapers, wagons, compressors, shovels, cranes, winches and hundreds of other useful tools. There has probably been more equipment attached or mounted on track-type tractors than any other type of portable power plant. And even after 34 years of manufacture we find more new equipment being designed each year for wider application of tractor power.

The early day tractors of 1904-05-06 were primarily



*Building Fill Over Swamp Land Between Flushing and Long Island City for New 8-Lane Dual Highway of Northern Blvd. in New York World's Fair.*

World War began shortly after this experimental work on bulldozers was started and the designing of equipment especially for use with track-type tractors was dormant for several years.

The war caused a tremendous increase in the facilities for manufacturing tractors which might not have come for another ten years of domestic consumption. At the close of the war when these plants were, you might say, returned to the manufacturers, they had a factory for mass production but a market that was just learning the uses of the products. This caused very intensive effort to rapidly develop equipment for tractors so as to widen the buying market and keep the factories busy.

The tractor salesman of that day had to not only find a market, but plan what equipment could best do the job and generally be on hand to teach the new operators how to get the most out of the equipment when it arrived.



*Bulldozing on Sky Line Drive in Shenandoah National Park Near Charlottesville, Va.*

The term "bulldozer" was originally applied to a machine shop tool that was used for upsetting or bending of metal into various shapes. The term was also applied in the mining industry for the breaking up of large rocks into smaller ones by mud cap blasting. It is easy to see how the name was applied to a blade mounted on the front end of a tractor for dirt moving. Probably one of the first uses of bulldozers in the east was on the lake shore development in Chicago. All the material excavated from buildings and the solid waste from the city were dumped on the lake shore. This material was then bulldozed into the lake. Peterson, Shirley and Gunther, long time Omaha contractors, used a bulldozer on one of their contracts in 1921 with excellent success, compared with previous methods.

Today we find bulldozers doing a great deal more work than the original designers ever thought would be possible; as a dirt moving unit on short hauls the bulldozer is hard to beat. Its efficiency greatly improves as the down grade becomes steeper. For example—on level ground the capacity varies from 2 to 3 yds., but when working on a down grade of 20 to 25 per cent we find the capacity jumps up to 10 to 15 yd. loads. Two bulldozers working abreast can move up to 25 yd. of mate-



*Bulldozers Working on Down Grade on Angeles Crest Highway, California.*

rial down a 25 per cent slope. Such performance soon makes short work of cuts.

Lumber companies found that a bulldozer unit could rough out skid roads and truck roads faster than any other type of equipment. Because of the bulldozer, areas have been economically logged that could not have otherwise been profitably reached. The chunking out of wind-falls and brush on logging roads has always been an expensive problem, but the bulldozer made short work of it.

Bulldozers have been used in many unusual ways. Probably one of the most unique was in San Francisco where a building wrecker had his tractor and bulldozer hoisted to the top floor of a building and the unit was used to help demolish the building. Oil companies have found a wide use of bulldozers to dig out slush pits around the wells. One farm in Oregon was saved from flooding by using a bulldozer to quickly throw up a dike to protect it from the flooding river.

### Snow Plows

"V" type snow plows were next developed for use on the front of tractors. Probably they were a com-



*Preparing Subgrade for Paving on Site of New York World's Fair.*

bination of the bulldozer idea and the long used "V" type plows for railroad locomotives. The early "V"-plows developed were hand operated but today's models have full power hydraulic systems for operating the main plow and also the wings. More modern plows have hydraulic control units easily operated by the driver in the cab. These tractor plows could readily push through deep snow, but a succession of snows soon caused tremendous piles on the edge of the road. This created a need for equipment that would throw the snow away from the road. Rotary type plows were introduced about 1922 to solve the problem of deep snows and high drifts. Cities used a single rotor plow arrangement for loading snow into trucks to be hauled away. One rather interesting discovery with such snow loading methods was that over twice as much snow could be loaded into a truck by blowing it in than was possible by hand shoveling. Blowing the snow in did an excellent job of packing it down. Conveyor types of snow loaders also were developed about this time.

These plows came at a very opportune time because the driving public was just becoming aware of the need of year 'round good roads. Open cars were the style when the roads were only passable during the summer



*V-Type Snow Plow Working Up a Hill Near Elmira, N. Y.*





## The World's Tough Truck Jobs Go to INTERNATIONAL

Building roads through the Long Beach Harbor oil fields with International Trucks. Scenes show 2 to 3-ton Model D-40's with 5-yd. bodies plowing through the mud holes with their full loads. F. D. Oneal, Long Beach, Calif., contractor, is the owner.

INTERNATIONALS get the hard, heavy jobs because these rugged trucks ask no odds, no matter how tough the going. They are as much at home in mud or muck, sand or water, as they are on the paved road. Their dependable performance under the most adverse conditions has won the respect and admiration of truck users everywhere.

Let International Trucks handle your own hauling. Enjoy the benefits of International performance, economy, long life, and after-sale service. Watch your costs go down and your profits go up when Internationals take over. There is a size for every hauling job, ranging from the Half-Ton Pickup to the powerful Six-Wheelers. See them at the nearby International dealer or Company-owned branch showroom.

**INTERNATIONAL HARVESTER COMPANY**  
(INCORPORATED)  
180 North Michigan Avenue Chicago, Illinois



# INTERNATIONAL TRUCKS



*V-Type Snow Plow at Work in Jones County, Iowa.*

months, but the advent of tractor snow plows helped create the demand for closed cars. Today there are very few open cars sold, which indicates how successfully the story of open roads was sold to the American public.

### Angling Type Blade Introduced

By 1928 the use of bulldozers had gone beyond merely pushing loose dirt around and an angling type blade was substituted for the straight-across bulldozer blade. Backfilling blades had been available prior to 1928 but their use was generally restricted to light side casting of loose dirt. These new units, called Trailbuilders, were pushed along the side of a hill or mountain, breaking a new road or forest fire trail ahead of them. Angling the blade greatly reduced the side draft on the tractor and gave the operator much more accurate control of both the tractor and the blade. The U. S. Forest Service was the pioneer of this type equipment and it has been widely used in building low cost fire lane roads.

The trailbuilder requires exceptionally strong construction because the blade is breaking out virgin material that usually contains rocks and stumps. New steels had to be developed to withstand this heavy punishment and the experimenting with different metals has had a far reaching effect on material used in bulldozers, snow



*V-Type Snow Plow with Wings in Hard Going.*

plows, scrapers, and other types of tractor equipment. This excessive punishment has also had a marked effect on the design and material used in the tractors. Today's tractors are heavier, more powerful models than those of twenty years ago.

### The Pushdozer

A new equipment unit called a Pushdozer has been developed by R. G. LeTourneau, Inc., to act as a helper in loading large scrapers. Contractors used to have snatch teams to help pull wagons up steep grades. Old time elevating graders used to have pushing teams in the rear to help load more dirt and reduce the team hookup in front. Snatch tractors have been used for years but the time lost in hooking cables to the front pull hook practically eliminated the advantages of using the extra tractor.

A pushdozer does away with the hooking inconvenience, as the operator can easily apply pressure against the back of the scraper at any time during the loading operation. Many contractors who operate three or more large size scrapers are using a pushdozer equipped tractor with a roter attached to the drawbar. Thus they can use the roter to loosen the dirt for easier loading when the tractor is not helping as a pushing unit.



*Rotary Snow Plow Removing Snow Drifts 6 Ft. Deep Near Marquette, Mich.*

A rather interesting comparison was made on one of the large California dirt moving jobs to see what effect a pushdozing unit had on the yardage production. The results obtained proved their value.

	Large Tractor With Pushdozer	Drawn Scrapers Without Pushdozer
Average loading time.....	0.97 minute	3.00 minutes
Average loading distance....	129 feet	300 feet
Average round trip haul....	1,700 feet	1,700 feet
Average hourly yardage....	121 pay yards	79 pay yards
Thus the pushdozer unit provided an increase in production of 53 per cent.		

### The Brushcutter and Treedozer

Another type of front end blade developed about the same time as the trailbuilder was the Brushcutter. This unit was first built in Canada, but now is manufactured in the United States by the LaPlant-Choate Manufacturing Co. The brushcutter is a V-type blade somewhat similar to a snow plow but having straight vertical sides. At the bottom and at right angles to the blade, a heavy, sharp, steel cutting edge is rigidly bolted. Thus, as the unit is forced through the brush and trees by the trac-





*Trailbuilder Building Logging Truck Road at Mountain Pine, Ark.*

tor, the cutting edge slices off the trees at the base by shearing action. It is possible with this unit to cut softwood trees even up to 14 inches in diameter. Several of these units have been used with excellent results in removing the trees and brush that have grown up in the Mississippi River bottoms. This large scale clearing work was to eliminate all trees in the back waters of reservoir flooded areas.

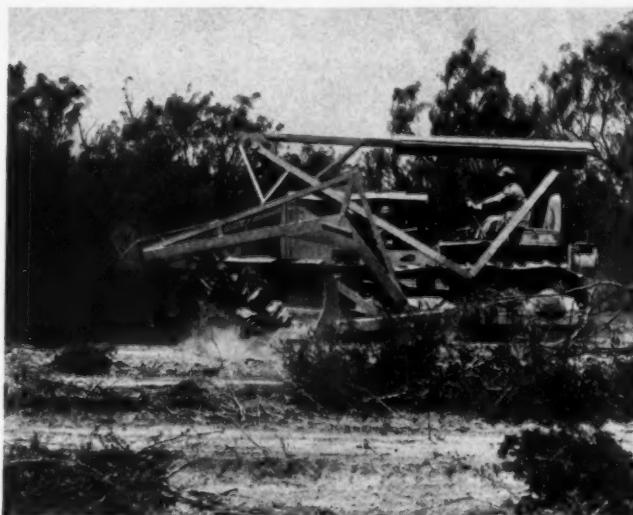
A second type of tree cutter is called the Treedozer, and it was developed during 1936 by R. G. LeTourneau, Inc., for clearing mesquite trees on the large ranches of southern Texas. The design of the treedozer is a combination of the brushcutter and the bulldozer with a



*Brushcutter Clearing Lane.*

pusher arm extending beyond the main blade to apply pressure several feet above the base of the tree. Applying pressure at this point bends the tree and causes tension on the root system so that the bulldozer part of the main blade can more easily root the tree out of the ground. The "V" part of the blade then windrows the trees and brush to the side. The cutting edge of the main blade is carried either at the ground line or slightly below to provide greater force at the root system. This type unit is very effective on mesquite or other species that have a short trunk and wide crown. The brushcutter type unit would have considerable difficulty in reaching the trunks of this type tree.

Both these units, the brushcutter and the treedozer, have made landclearing of brushy and thickly grown areas a much more economical operation than with the former hand cutting methods. Some rather startling results in lowering costs were obtained with a brushcutter on one of the Mississippi backwater, basin clearing contracts during the winter of 1937. The contractor started the operation with hand labor and found that 27 men could clear approximately 4 acres in an 8-hour day. A



*Treedozer Clearing Land Near Freer, Texas.*

Caterpillar D8 tractor and brushcutter moved onto the job and 10 acres were cut in 4 hours' time. A trailbuilder unit was then substituted for the brushcutter and the cut trees were windrowed into larger piles for burning. Thus one tractor cleared and piled approximately 10 acres a day or an equivalent of over 560 man-hours of labor by hand cutting methods. Like results were obtained on the mesquite clearing operations in Texas with the treedozer.

### Front End Shovels

Another very useful front-end mounted equipment item is the front end loader, or shovel. A  $\frac{3}{4}$  yd. digging bucket is carried on the front of the tractor by a vertical frame on which a hoist is mounted. The bucket is loaded by driving the tractor forward and picking up the load like a scraper. The bucket may be raised to any height on the boom to give the necessary dumping clearance. This type unit has become especially popular for excavating basements and other small jobs and for loading material into trucks from a stock pile. County and state highway departments are finding ready use for this shovel unit in removing dirt and debris that has collected in ditches. A blade grader cleans the ditch, depositing the dirt on the shoulder edge. The shovel then



*The Rushdozer at Work on the Altamont Pass Job, California.*

picks it up and either loads it into trucks or wastes it near the highway. A production rate of 20 to 60 yds. an hour may be obtained on such classes of work, depending upon the length of haul and type of material.

It is possible to remove the bucket on these loaders and substitute a bulldozer or trailbuilder type blade. This makes an excellent combination where the tractor may be needed for light pushing work. A larger 1 yd. bucket may also be used in place of the standard  $\frac{3}{4}$  yd. where lighter material, such as snow or ashes, are to be handled. Transport wheels or a trailer unit make it possible to rapidly move one of these shovel units from job to job. This is very important when the loader is used on cellar excavations, as the jobs are generally of short duration and widely scattered.

There are several other types of equipment mounted on the front end of tractors, but their use has been rather limited as they are more or less specialized equipment units for certain classes of service.

Front end winches are generally only used by public utility companies who have need for a wire stringing or pulling winch. Revolving brushes are also mounted on the front but their use has been rather limited. Small



*Tractor-Shovel Casting from Ditch to Shoulder.*

front end cranes have also been mounted on tractors for limited use.

In all these installations of equipment mounted on the front end of track-type tractors, the drawbar is free for use on practically any other type of pulling work. In most cases the rear of the tractor is available for installing winches, belt pulleys, pumps, etc. Many logging companies on the West Coast are finding it advantageous to have one or more tractors equipped with either a bulldozer or trailbuilder on the front, a single drum winch on the rear, and a logging arch attached to the drawbar. Contractors are finding it very profitable to mount either a bulldozer or pushdozer on the front and pull either a rooter or sheepfoot roller with the drawbar.

County and state highway departments are finding an ever widening use of conversion units. That is where a "V" type or blade snow plow may be used in the winter months and changed to a bulldozer or a trailbuilder for summer dirt work. Such changeovers can be made in a half hour's time. The same pump system that con-



*Tractor-Shovel Cutting Down Grade on Old Road.*

trols the bulldozer may also be used to power a carrying type scraper pulled from the drawbar.

Equipment is the link between the portable power plant, the track-type tractor, and the work to be done. The more hours an owner can use his tractor during a year's time, the more profitable its use will be to him.

### Traffic Accidents in Great Britain

During 1937, 6,633 persons were killed in traffic accidents in Great Britain, according to a report issued by the British Ministry of Traffic. This is an increase of 72 over the fatalities in 1936. Non-fatal accidents involving personal injury in 1937 decreased in number compared to those of 1936. The total for 1937 was 189,935 and for 1936, 192,619, a decrease of 2,684. The number of persons injured in 1937 was 226,402, a decrease of 1,411, compared with the injured figures for 1936. The number of pedestrians killed in 1937 (3,002) was the lowest recorded for any of the past ten years, and the total of pedestrians injured (72,647) was the lowest since 1930.





## FORMULA FOR BOND-BURNING CEREMONIES

Bond-burning ceremonies crop out in the news. It's a fine American custom—pleasant comment by civic leaders and happy "asides" among

\*\*\*\*\*

### 50 YEARS OF SERVICE

St. Paul, Minn., Virginia Ave., has completed a half-century of service. Neither weather nor traffic could best it. "It's still serviceable," says George M. Shepard, Chief Engineer, Dept. of Public Works of that city.

\*\*\*\*\*

Baltimore, Md.—The oldest streets paved with brick still in use were put down 39 years ago, on a sand base. I rode over these early brick streets recently, and, considering that they were laid by builders of the abutting houses, I found them to be in good condition, except that the surfaces were somewhat wavy; but, no doubt, they will be used for a number of years to come.

I also inspected the first brick street laid on a concrete base by the City, under my supervision in 1901, around one of our public markets. Despite the heavy traffic, this street is in fair condition.—Frank K. Duncan, Asst. Chief Engr., Dept. of Public Works, Baltimore, Md.



the taxpayers—as the torch is held to the cancelled bonds. And the pavement still good for years of service!

A study of brick pavements in Des Moines by Iowa highway authorities concludes that service will average 36 years; Columbus, Ohio, reports over 500,000 square yards which has already averaged 45 years of service; records of individual pavements run still higher.

The costs of upkeep on brick pavements is very low—often ranges from negligible to nil. The reason: Brick resists damage from weather as well as traffic. As built today it gives a durably smooth, safe passage to any type of traffic. National Paving Brick Association, National Press Building, Washington, D. C.

# BRICK

FOR NEW CONSTRUCTION OR RESURFACE JOBS

## BLUE RIDGE PARKWAY 33% COMPLETED

**T**HE Blue Ridge Parkway, the first of the long interstate parkways (a new development planned by the National Park Service of the U. S. Department of the Interior) is approximately one-third completed.

This parkway was conceived in 1933 to connect the Shenandoah National Park in Virginia with the Great Smoky Mountains National Park in North Carolina-Tennessee. When completed, it will extend approximately 480 miles from the Skyline Drive at the southern boundary of the Shenandoah Park to Newfound Gap Highway, at the southern boundary of the Smokies Park. The Blue Ridge Parkway is the longest single-unit recreational parkway now planned in the United States.

Another interesting parkway development is the Natchez Trace, eventually to run approximately 466 miles from Nashville, Tenn., to Natchez, Miss. Contracts have been let and construction work on it started during the past year.

The completed Mount Vernon Highway, from Washington, D. C., to Mount Vernon, is the first link in another planned parkway—the George Washington Memorial Parkway, Virginia-Maryland. Other interesting parkways are tentatively planned, as authorizations, funds and land become available.

Some idea of the future popularity of these parkways, and especially of the Blue Ridge, may be gauged by the fact that last year the Shenandoah National Park was visited by over a million persons, while the Great Smoky Mountains National Park was seen by nearly three-quarters of a million visitors.

The national parkways are co-operative Federal and State undertakings, the state furnishing the necessary right of ways and scenic easements, with construction funds appropriated by the Federal Government.

They are in reality elongated parks through which a major recreational travel route passes. Public protection is provided against invasions of commercial inter-

est, which could derive special benefits from a nonprofit development designed to serve the public by the broad right of ways and scenic easements.

The Blue Ridge Parkway is expected to average 800 ft. in width, its serpentine route crossing picturesque hill country at an average elevation of 2,500 ft. and climbing in some sections to a mile above sea level. Delightful contrast will be afforded as the road comes out on high ridge, then dips into forest-covered valley.

Although graded stretches of the Blue Ridge Parkway were open to travel during the past few months, the beginning of surfacing activities by the contractor has necessitated closing the road. It is not anticipated that the surfacing will be completed before early fall.

The portion of the parkway graded and ready for surfacing includes 8.5 miles between Jarman and Rock Fish Gaps and 47.3 miles between Adney Gap and the Pinnacles of Dan in Virginia; and 59.2 miles south from the north Carolina state line to Deep Gap. In addition, approximately 19 miles of grading in the vicinity of Mount Mitchell, North Carolina, still under contract, is scheduled for completion during the present season.

Excellent progress is being made on other sections of the parkway. Contracts recently were awarded for grading on 22.5 miles between Beacon Heights and McKinney Gap, in North Carolina, and bids have been advertised for grading 8.9 miles between McKinney Gap and Gooch Gap.

In Virginia, 33.6 miles between the Pinnacles of Dan and the North Carolina line will be ready for grading as soon as right of ways are made available by the state. Funds for this work are now available. This unit will connect the 47.3 mile graded unit in Virginia and 59.2 mile graded unit in North Carolina.

Future plans include grading of 7.7 miles between Gooch Gap and Buck Creek Gap in North Carolina as funds become available to connect with sections now

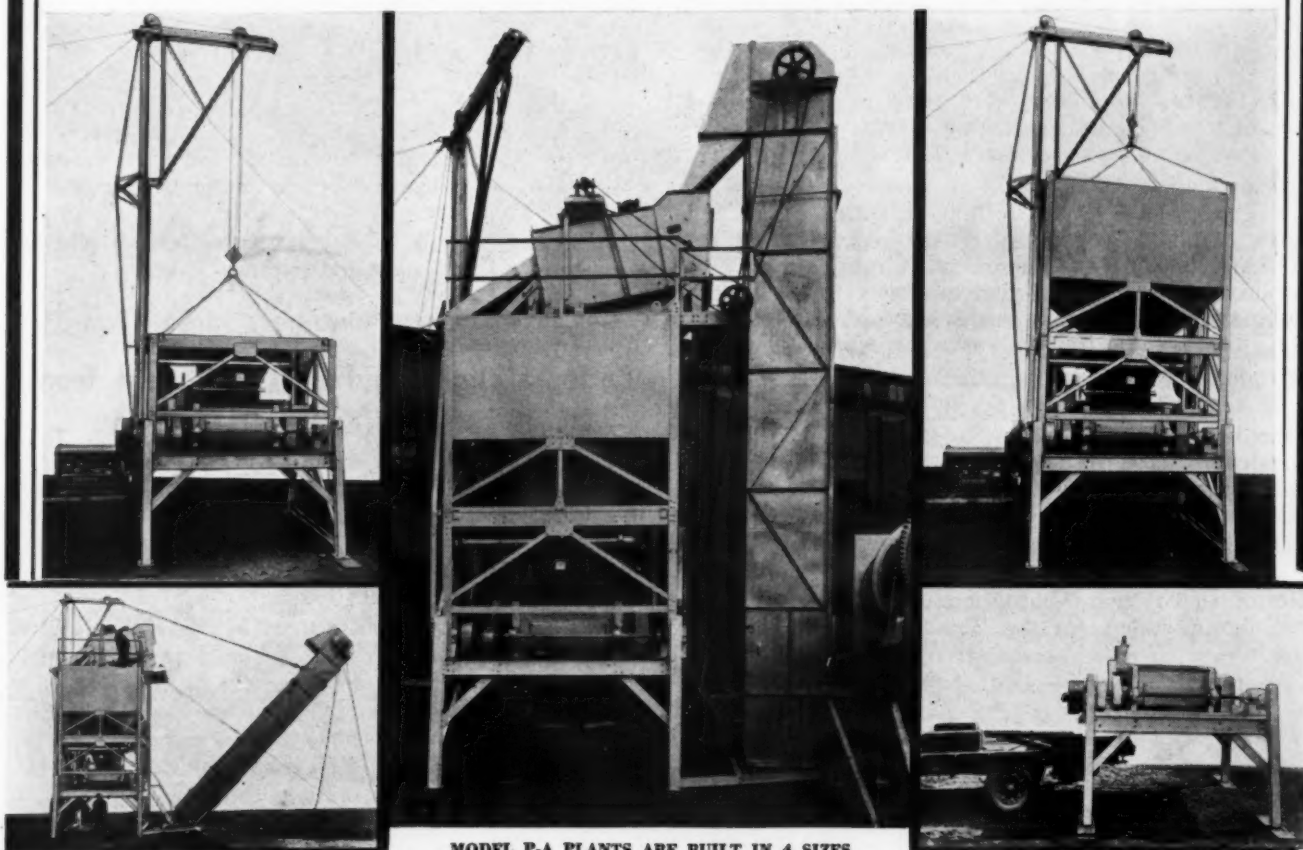


*A Section of the Blue Ridge Parkway*



# *Saves* ASSEMBLING TIME

**NOW FOR THE FIRST TIME** Large Capacity Portable Asphalt Plants Built in Complete Sectional Units. Capital Investment in Tires and Running Gear Avoided. Units of These Plants are each Complete and Self-Contained and can be Transported on Standard Hauling Equipment. Comply with Most Highway Loading and Road Clearance Regulations.



MODEL P-A PLANTS ARE BUILT IN 4 SIZES

MODEL PA-15.....1500-LB. MIXER  
MODEL PA-20.....2000-LB. MIXER  
MODEL PA-30.....3000-LB. MIXER  
MODEL PA-40.....4000-LB. MIXER

*With all latest improved features of  
H&B design.*

All comply with State Highway and Federal Roads Specifications.

**THE MOST EFFICIENT AND ECONOMICAL PORTABLE PLANT BUILT — LARGE CAPACITY — RIGID CONSTRUCTION**

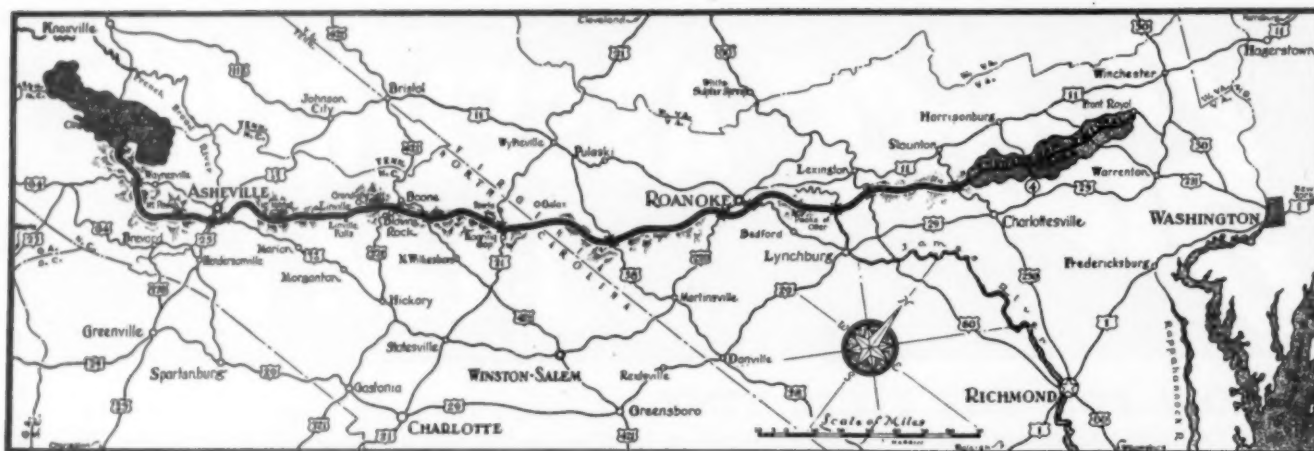
Patents Applied for.

Write for Bulletin T-260

## HETHERINGTON & BERNER INC.

ENGINEERS - MANUFACTURERS

701-745 Kentucky Ave., Indianapolis, Ind.



Route of Blue Ridge Parkway to Connect with the Shenandoah and Great Smoky Mountains National Park.

under construction. A section of 10 miles between Wagon Road Gap and Tennessee Bald, North Carolina, and two sections in Virginia, totaling approximately 16 miles, between Rock Fish Gap and Love Post Office, also are scheduled for grading as soon as right of ways and construction funds are made available.

Landscape work and parkway road maintenance are in progress on the graded sections in both Virginia and North Carolina, and contracts have been awarded for surfacing the long graded unit in Virginia and North Carolina. It is expected that contracts for secondary road locations and crossings will be awarded this season.

The states of Virginia and North Carolina are acquiring right of ways averaging generally 100 acres per mile in fee simple and 50 acres per mile in scenic easement.

Funds totalling approximately \$11,000,000 have been provided to date for the work. Of that amount, approximately \$6,800,000 was provided from Public Works funds and the balance by Congressional appropriation.

Definite plans for 1939 construction projects cannot be announced until after the passage of the current Interior Department Appropriation Bill, which contains new appropriations for the Blue Ridge Parkway construction.

Approximately two-thirds of the Skyline Drive in the Shenandoah Park has been completed and in use for several years. The southern third now is under contract, but will not be completed for another year at least.

### Western Association of State Highway Officials to Meet in Reno

The 17th Annual Convention of the Western Association of State Highway Officials will be held in Reno, August 10th to 13th. This marks the first time that a meeting has been slated for the Nevada city, and it is expected that large delegations will be sent from the 11 western states and Texas. The latter became a member of the group some 3 or 4 years ago.

One of the outstanding features of the convention will be a practical demonstration of safety equipment such as roadside markers, guard rails, etc. Prominent speakers including the President of the Associated General Contractors, Dr. L. I. Hewes, Deputy Chief Engineer, U. S. Bureau of Public Roads, San Francisco; Senators Key Pittman and Pat McCarran, and Congressman Scrugham

will be present at the affair with the latter three scheduled to make short addresses during the luncheon periods.

Lacey V. Murrow, Director of Highways in the State of Washington, is the President of the Association; Clyde Odin of the New Mexico Highway Commission is Vice-President, and Robert A. Allen, Carson City, Nevada, State Highway Engineer of the State of Nevada, is Secretary-Treasurer.

Entertainment offered during the conference will include trips to Lake Tahoe and Pyramid Lake.

### Federal Highway Funds Withheld from Massachusetts

The Department of Agriculture has announced its finding that Massachusetts has diverted State motor vehicle revenues to other than highway purposes in such manner as to make necessary the withholding of \$472,862 of the Federal-aid apportionment of \$3,171,423 for the fiscal year ending June 30, 1938.

This action is made mandatory by the Hayden-Cartwright Act of 1934 which requires that Federal-aid funds be withheld from any State using the proceeds of State motor-vehicle registration fees, gasoline taxes and other special taxes on motor-vehicle owners and operators for other than highway purposes in an amount greater than was being so used prior to June 18, 1934. The amount to be withheld may not exceed one-third of the apportionment for any fiscal year.

Massachusetts authorities were notified in October, 1937, that a study of the State's disposition of motor vehicle revenues disclosed an increased use for non-highway purposes subsequent to June 18, 1934. The State was called upon to show why a penalty should not be applied. A showing that could be accepted under the provisions of the law has not been made and the funds in question have not been restored for highway use.

Under similar circumstances \$250,000 was deducted from the apportionment to New Jersey for the fiscal year 1937. Maryland, Pennsylvania and Georgia were found to have used motor vehicle revenues for non-highway purposes to such an extent as to require Federal action. Maryland and Pennsylvania have restored the required amounts to highway funds and no further action is to be taken. Georgia officials have given assurance that they will follow a similar course but have not yet done so.



# Before you buy—LOOK AT THE NEW CHAMPION **GAR WOOD SCRAPERS**



Gar Wood L12 and  
Allis-Chalmers LO

*Here's why* so many contractors are buying Gar Wood's

1. Spring lift mechanism prevents stalling tractor and loss of time during digging operation.
2. Integral hydraulic system gives simple, dependable, positive control of all operations.
3. Light weight alloy steel construction means more pay load, less cost of upkeep.
4. Extended cutting edge concentrates digging power on a narrow blade and avoids sidebow friction.
5. Great stability provided by low center of gravity, long wheelbase and wide gauge rear wheels. See picture above.
6. Depth of spread is independent of dumping angle of bowl.
7. Short wheelbase for hauling means greater maneuverability.
8. Complete range of sizes lets you select most efficient scraper for your job.



Heaped load out of ditch

6 - 8 - 10 - 12 YD. SIZES



Heaped load on back sloping operation



Rear view after dumping and spreading



Spreading—cutting edge acts like a grader blade



Close-up of extension cutting edge

For complete details see  
your Allis-Chalmers equip-  
ment dealer.

ROAD MACHINERY DIVISION

**GAR WOOD INDUSTRIES, INC., DETROIT, MICHIGAN**

SCRAPERS • TRAIL BUILDERS • BULLDOZERS • RIPPERS • SNOW PLOWS • TAMPERS

## WITH A CAMERA THROUGH THE NEW YORK WORLD'S FAIR SITE

Browsing around the New York World's Fair grounds I noted some of the following:

1. Black concrete for roadways.
2. Tractors and bulldozers preparing subgrades, A. W. Banks contract.
3. Fill material hauled 2 or 3 miles from this borrow pit where Slattery Contracting Co. had a Lorain 77



keeping about 30 Autocar and Mack dump trucks busy. This pit is off Main St. extension, Flushing, L. I.

4. Sometimes the mats don't hold a shovel in the muck that underlies Flushing Meadows. This outfit sunk into the sticky blue gumbo near the site of the proposed Federal building. The cable-sheave hookup shown herewith was used to pull the shovel back up onto dry ground. Before the pulling crane hoist could hold its place, though, the heavily loaded truck shown was tied to it by cables to help hold as an anchor. Any outfit would have sunk here.

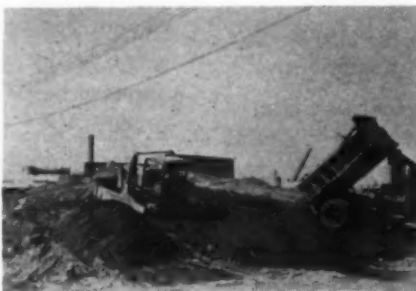


A much simpler plan would have been to place the end of the crane boom over the shovel and run a load line through its fair lead sheave. Support the end of the crane boom by two piles spread with butts resting on mats. A hitch on the boom base of the mired shovel could easily have lifted it vertically. When lowered onto an inserted mat, it could have moved out under its own power.

5. There is more sewer and underground work in progress at present than other construction but everything is in evidence.

6. A Lima crane was digging some sewer and underground work preparatory to removing the old approach of Northern Boulevard on the Flushing side of Flushing Creek. One half of the new bridge over Flushing Creek is complete. When finally finished this Northern Boulevard bridge between Flushing and Long Island City will be 8 lanes wide with sidewalks on each side.

7. Building the approach fill to the



bridge over Flushing Creek that will be the connecting link between Northern Boulevard and the Bronx-Whitestone suspension span. McDimond Contracting Corp. is doing the job. Trucks dump their loads and the Allis-Chalmers with bulldozer attachment pushes the load up the fill.

8. On the 8-lane road (when finished) between Flushing and Long



Island City—Northern Boulevard—these Cletrac and Caterpillar tractors with bulldozers are pushing the fill material over the mucky swamp subsoil. When a tractor passed I could feel the whole fill shake and shimmy 50 feet away from the tractor. This was the B. Turecaino & Co. contract.

9. On this same contract the dragline shown herewith was casting fill material into place. The grade of the new road will be several feet above



the present old black top road on a new location and all fill material must be hauled in.

10. A glimpse of the materials supply yards and barges on Flushing Creek looking toward "Bill" McDon-



ald's asphalt plant from the new Flushing Creek bridge of Northern Boulevard.

11. Transit mixed concrete is used to a large extent.

12. Highways of the parkway systems approaching the site of the fair grounds are well marked with illuminated directional signs.

13. Because the site was a tidal swamp originally, millions of cubic yards of dirt must be hauled in to raise the ground level. Consequently dirt moving is progressing in a big way.

14. A huge sewer is in process of construction. The invert is as wide as a 4-lane highway.



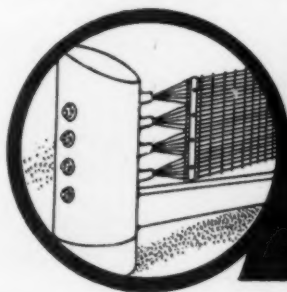


**HEAVY DUTY  
PROTECTION**

**FOR HEAVY DUTY TRAFFIC**

"Pittsburgh" Safety Highway Guard has a minimum tensile strength of 45 tons, providing a wide margin of safety for withstanding the heaviest impacts. • The twenty-four heavy, semi-spring steel horizontal wires which develop a minimum tensile strength of 190,000 pounds per square inch of steel, are woven into a 14-inch wide band. • The "Pittsburgh" Safety Highway Guard strength is combined with a resiliency which cushions

the heaviest traffic shocks and firmly shunts the vehicles along the guard. • Examination of 90-odd collision points by the Pittsburgh Testing Laboratory revealed that damage resulting from even the most violent impacts is quickly repaired on the spot by unskilled labor. Complete information on "Pittsburgh" Safety Highway Guard will be sent you on request. • Pittsburgh Steel Company, 1642 Grant Building, Pittsburgh, Pennsylvania.



**Pittsburgh**  
*Safety* HIGHWAY GUARD

## SIGNS OF TEXAS





# TEN TONS

**ON THE  
DOT!-**

**BUT TRINIDAD CAN TAKE IT!**



THE ten-ton truck is a major achievement of the machine age. It's also a challenge to the road builders of America.

Yet here's a startling fact. *Trinidad Native Lake Asphalt pavements laid down before the ten-ton truck was conceived are still giving fine service records.*

This is proof that Trinidad Native Lake Asphalt is an ideal paving material. One reason is because it is a native asphalt, "mined" from the famous natural asphalt lake on the southern Caribbean Island of Trinidad. It has the resiliency to withstand the shocks of heavy traffic. Trinidad Native Lake Asphalt is unique . . . it contains an inherent colloiddally dispersed mineral

filler, which stabilizes the asphalt in a manner not yet duplicated in any other asphalt . . . retains its essential properties over long periods. Its quality is uniform.

Barber invites highway engineers to learn more about Trinidad Native Lake Asphalt and its ability to provide low-cost-per-square-yard-per-year paving. Just clip and mail the coupon, pinned to your letterhead, checking the Barber Asphalt Paving Products that interest you most.

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# EDITORIAL

## Will Missouri Hold Its Place?

**D**URING some twenty years past, the cross-country roads of Missouri have been lifted from a condition of notorious mud to a place of high rank among our state road systems. Much keen foresight, competent administration, and genuine cooperative effort were necessary to do this, and Missourians take just pride in the accomplishment, but it can scarcely be claimed that the job is done: main highways, minor roads and city streets must still have years of active work to complete and bring them to modern standards of convenience, efficiency and safety.

During the past 10 years the State Highway Department has made the following expenditures for construction and costs incidental to construction. Bond interest, bond retirement charges, maintenance costs and administrative costs are not included in these figures:

	Trunk System	Supplementary (Farm to Market) System	Total
1928.....	\$10,544,145	.....	\$10,544,145
1929.....	18,365,591	\$ 49,406	18,415,087
1930.....	28,690,501	2,262,222	30,952,723
1931.....	27,183,419	4,279,154	31,462,573
1932.....	20,385,682	4,935,357	25,321,039
1933.....	14,882,762	5,817,367	20,700,129
1934.....	13,260,813	5,776,527	19,037,340
1935.....	8,905,163	4,984,833	13,889,996
1936.....	14,481,690	7,144,732	21,626,422*
1937.....	12,787,212	3,088,581	15,875,793*

But will the improvement be continued? Proceeds of the \$75,000,000 bond issue of 1928 are now exhausted, and the state faces the alternative of drastic curtailment or the raising of new funds. What such a curtailment might amount to can be judged from the fact that approximately \$9,306,000 will remain from the 1938 income after the payment of bond interest, bond retirement charges, maintenance costs, administrative costs, and other current requirements. The approximate \$9,306,000 includes federal aid, and is based on anticipated revenue. It is subject to fluctuation in event actual revenue exceeds or is less than the estimated amount.

As annual costs are not subject to large scale reduction, it is clear that highway income must be increased if construction and betterment are to meet the reasonable demands of traffic. Substantial federal aid will be forthcoming only if its grants are matched by the state. It is now proposed that construction funds be raised by an increase of one cent in the gasoline tax; and an initiative petition is being circulated to that end. In spite of the fact that Missouri's present tax of two cents is the lowest in the Union, and a total of three cents would leave it still as low as any of the other 47 states, opposition to the increase is so strong that it may not pass. This opposition, so far as we can learn, is based on three main arguments, emanating chiefly from three distinct sources.

*Argument No. 1.* Motor car operators should not be burdened with any additional tax. This is being pressed by the largest automobile club in the state and by some of the smaller clubs.

*Argument No. 2.* The petroleum interests should not be burdened with any additional tax. This argument is presented by several of the gasoline and oil companies.

*Argument No. 3.* Provisions of the proposed legislation governing distribution of funds grant too much

\*Increase over 1935 is largely due to grants of Federal funds which did not require matching.

to cities and primary state highways and not enough for supplementary (farm-to-market) roads. This argument comes naturally from county and other local sources.

Opposition to taxes is, of course, to be expected. The first gasoline levy in the United States, and most of those which followed, had to be fought through the same resistance. It should be scarcely necessary to point out, that had this opposition been successful, the auto or truck driver of today would have only a fraction of the road facilities now at his command. Widening, resurfacing, curve reduction, grade separation, new road construction, and a host of other items contributing to the motorists' use, convenience, safety and pleasure, would all be far behind; high speed could be maintained on a comparatively limited mileage; and it is even probable that stock automobiles would not have been developed for the speeds now generally accepted.

All this is known and admitted by most of the opponents, as well as the supporters of these earlier taxes. In fact, the motoring public, once it has understood, has actually welcomed a reasonably stiff gasoline tax because it knew this was the most practical way of getting improvements. Automobile club opposition has generally been based on the crass argument that a dollar saved its members was so much to its credit. We trust that the majority of Missouri club members see the crassness.

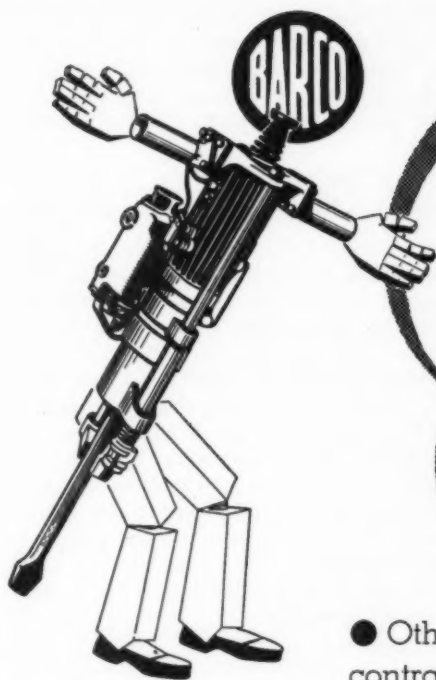
Perhaps few people have stopped to consider how really small would be the effect of the extra cent on their own pocketbooks, but here are the facts: In the year 1936, 548,211,000 gallons of gasoline was taxed by the State of Missouri for use in motor vehicles; and as motor vehicle registration in the same year was 809,615, the average consumption for each vehicle in the state was 678 gallons. An additional one-cent tax on this would have amounted to \$6.78, or 1.85 cents per day. For the small car owners, of whom there are so many, the average cost would be still lower. Not many motorists, we suspect, feel that road improvements are worth less than \$7.00 a year to them; but it is easy to forget that without the tax increase there will be comparatively little improvement in the period immediately ahead.

Bear in mind that while an additional cent on 548,211,000 gallons would yield \$5,482,110 for construction, this sum would be matched by federal aid, thus producing a total of nearly \$11,000,000.

Opposition of the petroleum interests is still harder to understand, for it is not conceivable that they overlook the vast amount of business which new roads and road improvements made with gasoline tax money have brought them. Do they think the taxes have materially reduced pleasure driving? If so, they show a poor understanding of human nature, as well as poor observation of facts. Have the taxes curtailed business transport and travel? Certainly in no such degree as the expenditure of their proceeds has increased them. And tax diversion, though a just cause of protest in many states, does not enter the picture in Missouri, which has had a constitutional provision against it since 1928.

But let us look at what actually happened to gasoline consumption in those states which increased their taxes in 1935 and 1936. A comparison of the five states having such increases with ten states in which the tax remained unchanged gives no evidence that the tax influenced the amount of gasoline used. (Note the table following.) What it does show very clearly is that gasoline consump-





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tion varies as prosperity varies—the southern states, which were improving rapidly during this period, all showing fine increases; while Nebraska and North Dakota, where the going was not so good showed respectively a small gain and a small loss. Furthermore be it noted that these southern states with the conspicuous growth in gasoline sales were also the states of highest gasoline tax rates. Also, that in addition to the states listed in our table, there were 18 others in which gasoline sales in 1936 were more than 12 per cent ahead of 1935, and of these, only Michigan had a tax as low as 3 cents per gallon, and only six states besides Michigan had taxes as low as 4 cents. Of the four states, other than those in the accompanying table, which showed less than 8 per cent gasoline increase, one had a 4-cent tax and three a 3-cent (right in the bottom group). These data are from the 1937 edition of "Automobile Facts and Figures," published by the Automobile Manufacturers' Association.

	1935		1936		Per Cent In- crease in Gasoline Taxed
	Tax Cts. Per Gal.	Millions of Gals. Gasoline Taxed	Tax Cts. Per Gal.	Millions of Gals. Gasoline Taxed	
Connecticut	2-3	264	3	287	9
Delaware	3-4	43	4	47	10
Louisiana	5	186	5-7	213	14
Nebraska	4-5	219	5	223	2
Pennsylvania	3-4	1,171	4	1,277	9
Arkansas	6½	132	6½	148	12
California	3	1,340	3	1,460	9
Florida	7	257	7	288	12
Illinois	3	1,015	3	1,123	11
Iowa	3	386	3	412	6
Minnesota	3	375	3	404	8
North Dakota	3	79	3	77	-2
Oklahoma	4	300	4	332	11
Tennessee	7	216	7	253	17
West Virginia	4	153	4	175	14

Lest we be accused of bias, we call attention to the fact that Missouri municipalities (unlike the cities and towns of most states) are empowered to tax gasoline; and needless to say, most of them take advantage of the opportunity. The maximum tax, however, in any of the municipalities is one cent per gallon. This brings the present maximum combined tax in Missouri to 3 cents, which may be compared with an average state tax of 4.4 cents for all the states, including Missouri, and a high of 7 cents in Florida, Louisiana and Tennessee. Incidentally, one of the characteristics of the approach to Missouri cities is the sign, "No City Tax" on filling stations.

The third objection to the proposed legislation comes, as has been stated, from the rural districts, which feel that they will be slighted in the distribution of tax proceeds, and would prefer to see legislation blocked until they can get something more to their liking. On this controversy, we can say little, for the subject requires careful study of local and general needs and resources—a study, incidentally, requiring facilities not generally available outside of the offices of the state and the large cities.

Several pertinent considerations, however, may be noted by the casual observer. Missouri, though commonly considered an agricultural state, has more than 50 per cent urban population. A considerable part of this urban group feels that in the past it has borne an undue share of the cost of local country roads. A proposed tax exemption on gasoline and diesel fuel used in farm machinery other than trucks and autos is resented in the larger cities.

Obviously, complete fairness between groups is not attainable (nor even closely approachable) by mathematical formula. Only a broad balancing of respective

needs and abilities to pay can supply a practical solution; and only a genuine spirit of cooperation and compromise can be expected to secure results. Missouri's people, who have achieved this before, can achieve it again. All groups will suffer if the state's highway improvement program is interrupted.

### One Man's Meat Is Another Man's Poison

PROBABLY what is one of the most striking anomalies ever to be presented to the highway industry has occurred in Washington, D. C. On the one hand we see the chief executive urging a spending program in excess of three billion dollars. On the other hand we see the Senate action with regard to H.R. 10140, Federal Aid for 1940 and 1941, in which drastic reductions were made in the Federal Aid bill as passed by the House.

The thing that looks so funny, and may indicate significant political trends, is the fact that the Senate made drastic reductions in Federal authorizations for an activity that affects more small business, more bread winners, and more of the population of this country than any other type of Federal spending, in the face of the President's suggestion that a huge additional "pump-priming" spending policy be enacted.

While the bill passed the Senate with a large majority it is doubtful if enough votes could be mustered to override a veto that was certain for the House measure.

What is difficult to understand is why our President should want to cut on highway work, from which the people derive value received, and want to spend billions raking leaves.

### Be More Specific

WHAT is a "low cost road"? This question is answered differently, we believe, because it is discussed too loosely in the language used. A low cost road and a low annual cost road are two different things.

For the first, general practice and consensus of opinion has arbitrarily established the upper limit of cost. For the second, the limits which are generally recognized are those of economic justification. A low cost road is defined as one in which the construction cost per mile for 20-ft. width of surfacing does not exceed \$10,000. This figure represents surfacing construction cost only and does not include grading and bridging. It does not take traffic density into account nor annual maintenance and depreciation costs. It is simply a 20-ft. surface a mile long that cost less than \$10,000 to build.

A low annual cost road is one in which the annual cost, as calculated by the Highway Research Board formula, is less than the annual savings to vehicles operating over the road after improvement is made. The cost of operating 1,000,000 vehicles per annum over a mile of road that has an inferior surfacing is \$ A. The cost of operating those same vehicles for the same period of time over a new surface is \$ B. So long as the difference (\$A-\$B) is greater than the annual road cost as calculated by the Highway Research Board formula, then the road may be said to be a low annual cost road. In other words, an economically justifiable road is a low annual cost road.

This differentiation has been recognized in the second edition of *Low Cost Roads and Bridges* by Brown and Conner. There are some engineers who will disagree with the limits established. It has been stated by recognized engineers that a low cost road should not exceed \$8,000 per mile for 20-ft. width and that bridging and grade line standards should conform. However, a low cost road is often a step in stage construction and is



# ENGINEERING TERMINOLOGY

DEFINITIONS OF  
TECHNICAL WORDS AND PHRASES

by

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Publishing Director,  
ROADS AND STREETS

and

D. G. RUNNER, A.B., A.M.  
Assistant Materials Engineer  
U. S. Bureau of Public Roads



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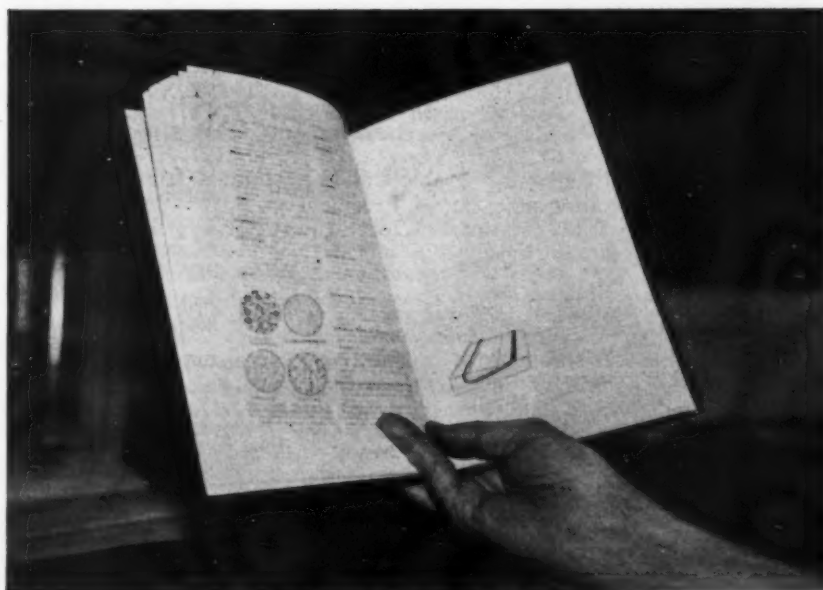
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often placed on a roadbed constructed to high cost road standards.

By speaking more specifically and qualifying our statements or the language of our discussions, we will not be so liable to misconstrue the meaning of the words, "low cost road."

### Tooling the Job

**I**N our zeal to lower production costs through quantity production of yardage we should proceed with caution. The "tooling" of a job is an administrative function requiring an economic study of construction management. Records, properly kept, and used, are valuable aids to the contractor. Unless they are used and kept in fairly complete detail they might just as well not be taken.

In past years, 10 to 15 mile contracts were not out of the ordinary. There is an unmistakable trend toward shorter projects. Several factors operate to cause this trend. There is no doubt but that, in the future, more 5 and 6 mile contracts will be let, than 10 or 15 mile units. This has an important bearing on job "tooling." Contractors must know the capacities of the various pieces of equipment in their plant setups and so fill in with new equipment that the whole will function to maximum capacity without sacrifice of capacity of individual primary units. Too often the item of secondary units, such as loading equipment, is underscheduled.

At first it may appear that "over-tooling" of secondary processes is unsound, as it leads to some extra expense. Under actual conditions, however, such does not prove to be the case. The use of oversize equipment for secondary processes insures against delays of the primary unit. The extra cost resulting from reduced output when a secondary unit fails (if the outfit is too closely in balance) is greater than the extra wear and tear cost of the higher priced secondary unit.

Too often the contractor bids off a job of a size economically unsuited to his plant. In actual practice the selection of equipment governs the more important methods of construction to be followed, and these dictate the size of the construction gang. We have then, a condition in which, in case of failure of a secondary unit, the daily overhead cost is fairly uniform and a cost of delay that mounts rapidly.

From this it may be seen that "tooling," in the light of present trends, requires close analysis of both the equipment and the job to be let.

### Remove Misunderstanding

**I**T may be easy to misunderstand the Legislative Bulletin of May 26, 1938, as issued by the American Road Builders' Association. This particular bulletin discussed developments of H.R. 10140, the federal aid bill for 1940 and 1941 authorizations. One paragraph stated as follows:

"Section 12—was stricken from the bill in the House, but was included in the measure as it passed the Senate. *The Conference Report* [Joint Conference Committee of House and Senate to iron out differences—Ed.] *strikes out this entire section.* The bill, if passed in accordance with the Conference Report, will carry *no penalty for diversion.*"

It is correct that this section was stricken from the bill by the Joint Conference Committee, but inasmuch as this measure is based on the Act of July 11, 1916, "and all Acts amendatory thereof and supplementary thereto," Section 12 of the Act of June 18, 1934, is applicable

to H.R. 10140, and the penalty for diversion will be invoked in accordance with that stipulation.

The Act of June 18, 1934, places Congressional Approval on the recognition of the fact that to tax motor vehicle transportation is unjust and unfair unless the proceeds of such taxation are applied to construction, improvement or maintenance of highways. It also provides that up to one-third of the amount of federal aid to which a state may be entitled may be withheld if funds collected from motor vehicle fees, gasoline taxes, or other special taxes on motor-vehicle owners by states are used for other than highway purposes.

Even though this provision is not included in the federal aid bill now pending, the fact that it was included in the Act of June 18, 1934, supported by the stipulation of the Act of July 11, 1916, leaves federal highway aid funds protected against diversion, and the penalty will be invoked.

### Immediate Prospects

**B**ECAUSE of the rapidity of changes which the Federal Highway Aid and the Spending-Lending bills have experienced on their journeys through both bodies of the National Congress, a general summary of the status quo is in order. For a proper understanding of the situation it would be best that the reader have a complete knowledge of the procedure through which proposed bills must pass from the final draft by the author to the signature of the president. A discussion of this procedure is out of place here. We shall merely summarize the figures of funds that may probably be authorized by the two bills mentioned above. We wish it clearly understood that the bills, as this is written, have not yet been signed, nor is the second one in its final form yet. However, while there might be a slight change in the Spending-Lending bill, the Federal Aid bill has been through the Joint Conference Committee and has been accepted by both branches of Congress.

As the picture now stands, the following table indicates funds to become available:

	Federal Aid	
	1940	1941
Regular Federal Aid .....	\$100,000,000	\$115,000,000
Farm-to-Market Roads .....	15,000,000	15,000,000
Grade Crossings .....	20,000,000	30,000,000
Forest Roads .....	10,000,000	13,000,000
Public Lands Roads .....	1,000,000	2,000,000
National Park Roads .....	4,000,000	5,000,000
National Parkways .....	6,000,000	8,000,000
Indian Reservation Roads .....	2,500,000	3,000,000
Flooded Roads Aid .....	8,000,000	.....
Sub-totals for roads .....	\$166,500,000	\$191,000,000
Carry over authorized for Jan. 1, 1939 .....		\$150,000,000
Regular Federal Aid, already allotted, 1939 Fiscal Year .....		195,000,000
Proposed probable additional funds from Spending-Lending program of President:		
Requested earmarked for highway for expenditure in Calendar Year 1938 .....		\$150,000,000
Street and Highway portion of WPA, 1939 Fiscal Year funds .....		484,500,000
Bridge and Highway portion of WPA, 1939 Fiscal Year funds .....		86,500,000
A summary of prospective Federal funds only, appears as follows by years:		
1938—Calendar Year, Relief Funds .....		\$150,000,000
1939—Calendar Year, Carry Over .....		150,000,000
1939—Fiscal Year, Already Allotted Regular Highway Aid .....		195,000,000
1939—Fiscal Year, WPA and PWA .....		571,000,000
1940—Fiscal Year, Federal Highway Aid .....		166,500,000
1941—Fiscal Year, Federal Highway Aid .....		191,000,000

These Federal Aid funds provide the states now with assurance of future planning so that delayed projects may now get under way.



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### Port Arthur-Orange Bridge Nearing Completion

The Port Arthur-Orange bridge over the Natchez River on Texas Highway 87 will be opened to traffic early this summer at Port Arthur, Tex. This \$2,750,000 structure has been financed by the Public Works Administration, the Texas Highway Commission and Jefferson County, Texas. It is 1½ miles long and rises from a flat marshland to attain an extreme height of 230 feet.

To give a comfortable leeway above the mast tops of the tallest ocean-going ships, the bridge provides a vertical clearance of 176 ft. above water, which is 43 ft. greater than the Brooklyn Bridge and 41 ft. more than the Huey P. Long bridge at New Orleans. The distance between the main piers is 600 ft.

gas mileage, their usage and their taxation. Some 39,000 motor vehicles representative of the entire 1937 registration, were examined and classified by year models before statistical stability was reached. The sample was completed and analyzed in September, 1937, just prior to the introduction of 1938 models by the manufacturers.

A proper proportion of all the makes, types, year models and locations of motor vehicles throughout the state was included in the study which was carefully analyzed and adjusted in accordance with correct statistical principles. The results of this analysis are shown in the table. About 52 per cent of the vehicles operating today are 1933 or older models. Around 36 per cent of the automobiles in North Carolina are 1935 or newer models. The average age of all models is about four years.

The Division of Statistics and Planning of the State



The \$2,750,000 Port Arthur-Orange Bridge Over the Natchez River on Texas Highway 87

A special feature of the span is the A-shape of its supporting piers, with lateral outward spread to resist high velocity winds. The main piers rest on concrete columns 32 ft. in diameter, sunk to depths of more than 100 ft. below sea-level.

The bridge will permit two-lane traffic over a concrete slab 22½ ft. wide, flanked by 18-in. emergency sidewalks.

### 25% of Motor Vehicles on North Carolina Highways Are Over 8 Years Old

About one-fourth of the motor vehicles operating in North Carolina are more than eight years old, according to a study completed by the Division of Statistics and Planning of the North Carolina State Highway and Public Works Commission. In numbers, there are about 140,000 vehicles over eight years old, including about 4,000 vehicles over 15 years old. This extremely old group includes vehicles ranging from 1923 models back to 1914 models and older.

This study was conducted as a phase of a general study of North Carolina motor vehicles; their location, their

Highway and Public Works Commission made the study and analyzed the data under the direction of James S. Burch, engineer of Statistics and Planning.

#### NORTH CAROLINA—1937 MOTOR VEHICLE COMPOSITION BY YEAR MODELS (Includes Trucks, Trailers, Busses, etc.)

Year Model	No. in Sample	% of Total (Adjusted)	Indicated Total No.
1923*	284	0.7	3,951
1924	292	0.7	3,951
1925	472	1.2	6,773
1926	798	2.1	11,953
1927	1,088	2.8	15,804
1928	2,715	6.9	38,946
1929	4,061	10.4	58,701
1930	3,063	7.8	44,025
1931	3,120	8.0	45,154
1932	1,673	4.3	24,270
1933	2,859	7.3	41,203
1934	4,450	11.4	64,345
1935	4,540	11.6	65,474
1936	4,645	11.8	66,603
1937	5,120	13.0	73,376
Total	39,180	100.0	564,429

\*Includes older models.



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BETWEEN THE CARRIAGE WHEELS; THE TRACKS WERE APPROXIMATELY  
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## Centerstriping Low Cost Bituminous Surfaces

For several years there has been a demand by the driving public of Missouri for some sort of a center-stripe on the low cost bituminous surfaces. As a result the State Highway Department decided to place a broken dot and dash white center stripe in all of these roads. The following account of how this work was handled is taken from a paper presented by J. A. Johnson, Engineer of Special Assignment at the 1937 Montana National Bituminous Conference.

During the fall of 1936, 1,815 miles of the above type of line was placed and the reaction from the traveling public was exceptionally favorable. The white dot is approximately 20 ft. in length, while the blank gap is double this length. This was done by letting the paint flow during two revolutions of the rear wheel of the striper and leaving the paint flow shut off during four revolutions. This striping is done at a rate of approximately 12 miles an hour, and it was found that an operator could not react fast enough to adjust the dot for one revolution of the rear wheel. Various lengths of stripe and gap were used, and it was found that the shortest feasible stripe gave much better visibility at night, due to the fact that several stripes were visible within the range of car headlights.

The same specification material as used for solid stripe on high type surfaces was used on the low cost bituminous surfaces. Operations ordinarily were started after the heat of the summer and beyond the time when any bleeding could be expected and retreatments had been completed. By this time most of the surfaces had dried out and become stable. The solvents used cause rapid drying of the centerstripe without any excessive solvent effect on the bituminous pavement. There is just enough softening to cement itself thoroughly to the pavement.

In placing the dot and dash system, a solid centerline was used over hilltops with less than 800 ft. sight distance and around blind curves or those with less than 300 ft. radius. Approximately 9 gals. of paint was used per mile of finished stripe. The cost of labor, material, and equipment averaged slightly less than \$14.00 per mile for the finished stripe.

A survey of these traffic stripes during the winter and spring showed that they were of great assistance to night traffic. On ordinary low cost bituminous surfaces there is no definite demarcation between the edge of the pavement and the shoulder, and night traffic has no distinct line to follow at this point. The white centerline shows up especially well at night and is of considerable assistance to traffic. The stripes placed last fall gave good service until May and June when some bleeding and tracking occurred. The early maintenance on the low cost bituminous surfaces occurs from May to September, and during these months of the year most of these roads will be without the white centerstripe. This cannot be avoided in this type of construction and all of the efforts have been to develop a low cost stripe which will pay for itself in the six months to eight months service obtained. The Department has experimented with some cheaper type formulas and next year it may be able to reduce costs still more due to a saving of \$2.00 to \$4.00 a mile in the cost of cheaper formula paint which will give six to eight months service without difficulty.

104 ITEMS ON A.S.T.M. ANNUAL MEETING PROGRAM  
—In the 17 formal sessions of the 41st annual meeting of the American Society for Testing Materials to be

held at Chalfonte-Haddon Hall, Atlantic City, June 27 to July 1, inclusive, there will be presented 104 technical papers and reports covering important topics on a large number of engineering materials.

## Sewer Excavation Goes Into Highway Embankment

Embankment fill for the West Side drive in New York City requires large quantities of whatever materials may be available and suitable. The writer happened on the job when sandy material was being dumped by Dempster dumpsters. It was discovered that the material was excess excavation from a WPA sewer job at 125th and Amsterdam Avenues. It being necessary to do excavation by hand, the dumpster has proven to be just the unit for removing excavated material.

The present sewer is overtaxed so a new concrete box sewer is being built alongside the old one. The old one



*Dumping Excavated Material to Make Embankment for the West Side Drive.*

is being enlarged. Earth is shoveled out by hand and loaded into the ever ready dumpster bucket. A series of trucks, equipped with the Dempster units, haul between the sewer and the road fill.

It is realized that were the job to be done by contract that more equipment would be used and the cost per cubic



*Loading the Hauling Equipment. All Excavation of the Sewer Is Done by Hand—a WPA Project.*

yard of excavation would be considerably less, but, since the job is a WPA project and hand excavation must be used, those in charge of the job have reduced costs by the use of these units. A truck and 5 buckets are rented to the WPA for \$34.50 per day. Out of this the contractor must pay the chauffeur the union wage.





# South Bend



## BITUMINOUS MATERIAL DISTRIBUTOR



Purchased by Truman L. Platt, Springfield, Illinois

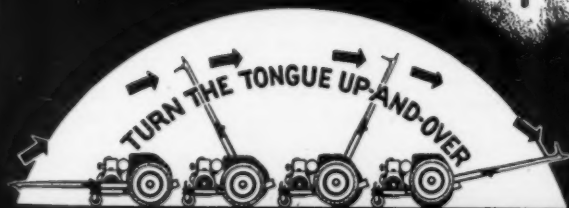
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WRITE FOR CATALOG

MUNICIPAL SUPPLY COMPANY  
SOUTH BEND, INDIANA



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TO THE JOB—A TRAILER — ON THE JOB—A ROLLER

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**COMPACTION.** 150 lbs. per inch of roller width. More than other portable—equal to many large tandems.

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Model No. 150 has brakes, water tank and moisteners on front and main rollers, and 6 h. p. Wisconsin motor.



150 LBS. COMPACTION

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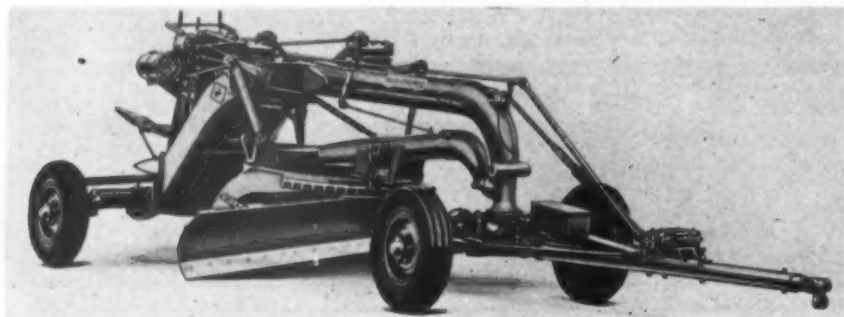
LITTLEFORD BROS.

454 EAST PEARL STREET CINCINNATI, OHIO

## NEW EQUIPMENT AND MATERIALS

### New Blade Graders

Two models of the new line of graders, the numbers 110 and 112, being manufactured by the tractor division of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., were first shown to the trade at the Cleveland Road Show in January, 1938. These machines were designed and developed to provide graders that would have strength, balance and a wide range of usefulness to accomplish economically the close tolerances and improved finishes required in road work. A tubular single section frame is used in the models 110 and 112. All welded construction is used throughout. Cast steel is used to form parts which require unusual shape to obtain maximum strength where complicated stress applications prevail. Structural angles, channels and plates are utilized



*New Allis-Chalmers Blade Grader*

where bending stresses predominate. The outstanding construction feature of the machine is the patented Allis-Chalmers leaning frame. The frame, lean and long, fully shiftable rear axle, gives the machine very effective stability. The leaning frame enables the operator to concentrate the weight of the machine on the blade when desired. Operator comfort and ease of operation of the controls are accomplished by use of the frame lean, which provides a level spring-mounted platform, even though the rear axle is inclined on a 25 degree slope. Leaning wheels furnish additional stabilizing force to hold the grader on steep bank cutting and ditching positions. Lift cases are mounted forward above the circle to eliminate torsional deflection. For standardization only two sizes of worm gears are used in each model. All gear cases are mounted to reduce strains and to provide easy accessibility. Automatic brakes prevent the control shafts from creeping when the control clutches are disengaged. Self-aligning bearings on the gear cases prolong the life of the bearings and gears. Pneumatic tires, when desired, are selected from sizes commonly used for other construction purposes. A wide range of efficient blade positions is obtained on the 360 degree rotation of the crank arms. The drawbar has a ball and socket connection. Its low line of draft results in a very effective blade capacity.

### New Cab Over Engine Truck

Featuring greater load space, driver comfort with short wheel-base, easy cab accessibility, conveniently arranged controls and openings for oil, water and fuel, a new cab-over-engine truck is announced by the



*Ford V-8 Cab-Over-Engine Dump Truck*

Ford Motor Co. Introduced in response to a definite demand for a Ford V-8 unit of this type, the new cab-over-engine truck is available in two wheelbase lengths, the 101-in. wheelbase and the 134-in. wheelbase.

other types of bortz set core drill bit. Faster drilling speed and greater footage per bit are also claimed. Koebelite Korbits consist essentially of a number of bortz-bearing inserts accurately located and firmly brazed into radial slots in the face of the bit blank. By means of an ingenious process developed and patented by C. J. Koebel of Detroit, the stone-bearing insert or metal matrix, and the stones, are moulded and integrally bonded together. Even temperature changes cannot affect this bond. Because the stones are set in the inserts with mechanical precision and in accordance with a definite field proved pattern and because the inserts are located with close limit gauges, an absolutely uniform contour gauge is claimed to be achieved which gives maximum cutting speed and insures straighter hole. These outstanding new bits are available in any style and size. Copies of descriptive literature can be secured from Sullivan Machinery Co., Michigan City, Ind.

### New Stabilizer Plant

The new Cedar Rapids stabilizer plant for mixing clay-soils, aggregates, calcium chloride, salt, etc., has been announced by the Iowa Manufacturing Co. of Cedar Rapids, Ia. A few of the outstanding features claimed for the Cedar Rapids stabilizer plant are: positive non-clogging clay-soil feeder, accurate proportioning devices, low operating height, a self contained, highly portable unit, large capacity and low operating costs. The plant consists of one main truck unit, pneumatic tired, on which is mounted the various processing units. Because the plant setup is generally made at stock piles, the stabilizer plant is designed for clam shell feeding with large receiving hoppers above both the aggregate and clay-soil feeders. The finishing mix is discharged onto a delivery conveyor which can be designed for direct truck loading or delivery to a storage loading hopper or bin. The aggregate is fed through the aggregate feeder in predetermined quantities direct to the pugmill. The clay-soil is fed by mechanical screws to the short belt conveyor leading to the disintegrating crusher where the clay-soil is processed to specifications and then discharged to the pugmill. A separate cal-



*New Cedar Rapids Stabilizer Plant*

The 101-in. wheelbase chassis is offered with stake platform body, dump body and as cab and chassis. The former has a load length of 106 in. and a load width of 82 in. Load space of the dump body is 84 in. long, 66 in. wide and 12.62 in. high. Capacity is 1½ cu. yds. The 134-in. wheelbase chassis is offered with stake platform body and as cab and chassis. Load length of the platform body is 142 in., load width 82 in. The length of the stake platform body on the 101-in. cab-over-engine truck is the same as on the conventional 134-in. unit and similarly the length of the body on the 134-in. cab-over-engine truck is the same as on the conventional 157-in. unit. Both the 101-in. and 134-in. chassis are offered in driveway type for mounting special bodies. This chassis includes hood, cowl and windshield. Construction of the cab-over-engine truck is the same as the conventional models except for changes made necessary by the cab-over-engine design. Most major parts such as power plant, rear axle, rear springs, steering gear, etc., are interchangeable.

### New Core Drill Bit

The Sullivan Machinery Co. has released literature descriptive of a new revolutionary type of core drilling bit known as the Koebelite Korbit. In terms of bit cost per foot of hole drilled, savings of 15 to 20 per cent are claimed in comparison with



cium chloride or salt feeder is used to introduce these items and so designed so the feed is in constant proportion to the balance of the materials according to specifications. The mixing is done in a long single shaft pugmill which can be raised or lowered from the horizontal operating plane as required to secure the best mix. The entire plant is operated from one power unit which can be either gas or Diesel, at the option of the purchaser.

### Control Device for Bulldozers and Trailbuilders

A unique control device has been perfected for operating the bulldozers and trailbuilders of Kay-Brunner Steel Products Co., 2721 Elm St., Los Angeles, Calif. The device uses the same control lever for tilting the blade as for the regular horizontal adjustments. It is an improvement over the early type of K-B tilt control used a few years ago, which was operated by a second lever. This newer model incorporates compactness, lightness in weight and speed of operation. The speed or operating efficiency of the new control can be compared to that of a car shift lever. The change of blade tilt or horizontal adjustments are made as quickly as the lever is shifted. When the lever is in the center slot it raises and lowers blade in the horizontal position. By shifting lever into right hand slot it operates right hand ram and right hand corner of blade. With lever in left hand slot it operates left hand ram and left hand corner of the blade. When lever is placed in neutral position

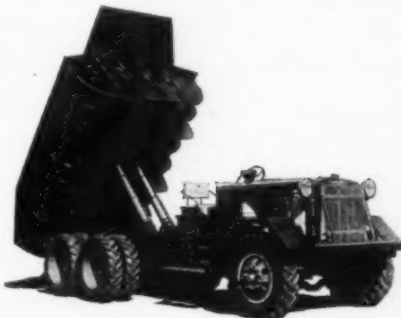


New Control Device for Bulldozers and Trailbuilder

the oil is by-passed through the valve. The new single lever blade corner control allows the operator to dig with one corner of blade as long as necessary, and then while tractor is in motion the lever can be quickly shifted to level the blade, if desired.

### New Heavy Duty Truck

The Hug Co., Highland, Ill., has just completed shipment of four of its large "Caterpillar" diesel powered Hug luggers to the Gulf Oil Corporation for Meme Grande Oil Co., Venezuela, South America. This model 36 Hug lugger is a specially designed heavy duty dirt and rock moving



New Model 36 Hug Lugger

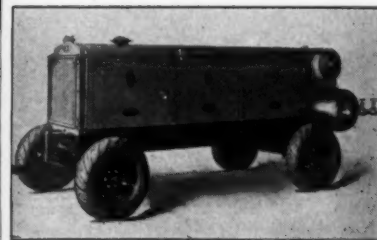
unit, equipped with a 10-12 yd. Boulder Dam type body, with twin cylinder hydraulic power hoist. Other features of construction include the "Caterpillar" full Diesel engine, the dual drive double reduction rear axle, a 4-speed unit and 3-speed auxiliary transmission, all-welded I-beam frame and 11.25 by 24 single front, dual rear Groundgrip tires. The body is reinforced with  $\frac{1}{4}$  in. bottom plate and  $1\frac{3}{4}$  in. oak filler and the canopy over the driver's seat protects the driver and seat box from falling material. The four Model 36 Luggers shipped to the Meme Grande Oil Co. were also equipped with extra equipment consisting of Tulsa Model 70 winch, fifth wheel and bolster supports. This optional equipment is interchangeable with the power hoist and body. When the truck is not used with the power hoist body, the body is removed and the winch and fifth wheel are mounted on the chassis.

### New Small Sweeper

A small, simplified sweeper that cleans  $5\frac{1}{2}$  ft. of pavement at a single pass, has been developed by The Austin-Western Road Machinery Co., of Aurora, Ill. Though it thoroughly sweeps any part of the street, according to the manufacturers, it was engineered primarily to clean the gutter area where dirt usually collects. It is equipped with two revolving brooms and can be used the year around to pick up litter, cinders, leaves, broken glass and even bricks.

The Patrol Sweeper, as it is called, is completely equipped and is very compact. It is powered with a 4-cylinder, 29 H.P. motor for operation on steep grades as well as on level pavements. To lay the

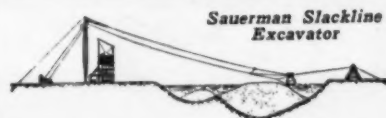
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The first cost of a Sauerman machine is less than that of any other equipment of equal range and capacity. Moreover, the machine is easy to operate and maintenance expense is small.

Many different jobs where materials have been dug, hauled and placed for a few cents per cubic yard are illustrated in the Sauerman Catalog. Write for this book.

SAUERMAN BROS.  
488 S. Clinton St. CHICAGO





New Small Sweeper of Austin-Western

dust and penetrate crusted dirt it uses a pump driven spray. To scour the pavement near the curb where dirt formations are thickest, it uses a "bump-proof," fast revolving steel broom, that flares out to 32 ins. To pick up litter and leave a clean surface it is equipped with a tough, fibre broom measuring 36 ins. in diameter. The rotation of this broom throws the dirt and rubbish into a one cubic-yard capacity trash box. When the operator wishes to dump the load, he fingers a small (hydraulic power) control lever which automatically raises and tilts the trash box and deposits a compact load behind the sweeper. With this arrangement sweeper can continue its work without backing up or tracking over the load. The company man-

ufacturing this sweeper states it has spent a number of years in developing and perfecting the Patrol Sweeper and that it is now in production.

### "Finger Tip" Hydraulic Control for Pavers

Hydraulic control is now furnished on the single and dual drum pavers of the Ransome Concrete Machinery Co., Dunellen, N. J. This hydraulic mechanism controls the boom swing, discharge chute, transfer chute and water tank valves and is maintained by means of a simple oil pump driven off the engine transmission shaft. This type of control as pertains to the boom swing is stated to give a better control and smoother action of the hydraulically operated boom which has a swing of

this purpose, to unnecessarily increase the overall dimensions of the mixer. The end discharge feature permits wheelbarrow spotting, without turning or backing. The

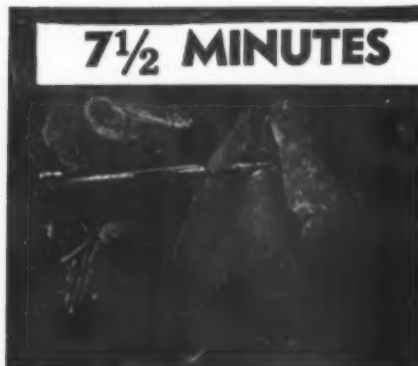


New 3 1/2-S Mascot

mixer weighs less than 1,000 lb. and is easily handled, spotted or trailed. Many other additional features add to the greatly increased efficiency of this machine.

### New Expansion Joint Filler

A new filling material for expansion joints consisting of a specially compounded rubber latex with fillers has been placed on the market by Rubber Associates, Inc., 1790 Broadway, New York, N. Y. In applying these "Joint-Lok" expansion joint seals the materials are furnished to the



**7 1/2 MINUTES**

### WITH THE— ATLANTIC PNEUMATIC ROCK BREAKERS

**NO  
PLUGS  
AND  
FEATHERS  
NO  
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Splits rock fast. Uses your air equipment. Cuts rock handling costs. No tool upkeep. Nearly 4 1/2 times faster than using feathers and wedges. Fool-proof. Tougher than any stone. Amazing performance. First cost is last. Get this new tool for that next job.

**ATLANTIC STEEL COMPANY**  
1775 Broadway, New York, N. Y.

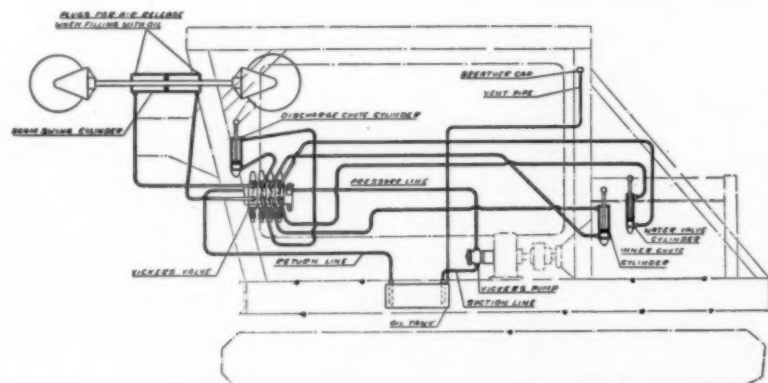


Diagram of Hydraulic System

170 degrees. The boom can be swung whether the mixing drum is revolving or not. Boom is locked when control valve is in neutral position. This mechanism is stated to have eliminated many moving parts and makes very simple the conversion of a standard paver into a tower paver.

### New 3 1/2-S Mixer

A new 3 1/2-S mixer, designed and built by the Kwik Mix Concrete Mixer Co. of Port Washington, Wis., has an air-cooled gasoline engine mounted within the natural overall dimensions of the mixer proper. No additional structure has been added for

contractor in separate containers and are mixed on the job as required for actual installation. After being properly mixed, the filler has the consistency of a soft pudding and is ready to be poured over the pre-molded joint strips which separate the concrete slabs. These pre-molded joint strips are laid when the concrete slabs are placed in position on the road surface, and fill the lower portion of the depth of the joint. They may be composed of cork, rubber, or other approved materials. The surfaces to be joined together by the expansion joint filler must be thoroughly cleaned of all foreign matter and be substantially dry. A priming compound must





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**EAGLE**  
*Sublimed*  
**BLUE LEAD**  
STOPS RUST CHEMICALLY

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Gives a better mix and smoother surface to heavy mat or stabilized base—IN ONE PASS! Send for Catalog and actual job records.

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Popular Priced,  
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21 Ft. Straight Edge  
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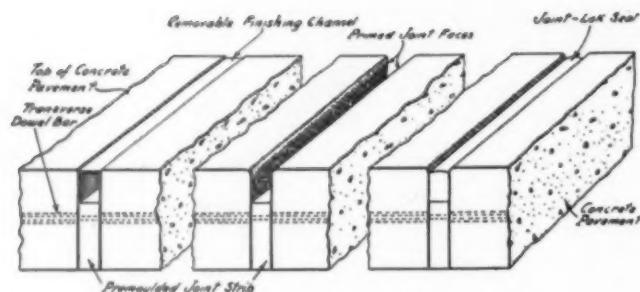


## "SPEED--PROFIT-- SATISFACTION!"



Three-in-one when you use "FLEX-PLANE"  
finishing machines, joint installing machines,  
and dowel rod spotters.

**FLEXIBLE ROAD JOINT MACHINE COMPANY**  
WARREN, OHIO



Method of Applying Filling Material

also be applied to the dry surfaces to be joined. The primer is generally applied with a stiff brush to the thickness of a heavy brush coat, and is allowed to set for a few minutes until tacky before the filling solution is poured. An ordinary pouring can such as a watering can, with a  $\frac{3}{4}$ -in. or 1-in. spout, is used for pouring. According to Rubber Associates, the "Joint-Lok" Seal has been thoroughly tested and found to be impervious to water, to bond well to the sides of concrete slabs (when coated with a priming compound), and to be sufficiently elastic to adhere to the concrete sides both during expansion and contraction of the slabs.

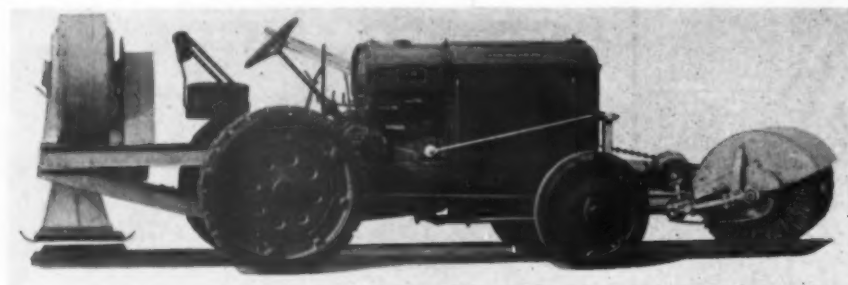
### New Tractor Sweeper-Blower

A tractor sweeper-blower engineered to meet the requirements for a mobile unit that would both sweep and air-clean the base before the prime coat was applied has been placed on the market by The Frank G. Hough Co., 919 North Michigan Ave., Chicago, Ill. The unit consists of the



Model EFU Rated at 14,000 lb. Gross

accomplished. The EEU, EFU and EGU are offered in the standard wheelbase length of 107 in. Special wheelbase lengths of 114 in., 126 in., 144 in., and 162 in., are also



Tractor Sweeper-Blower Unit

Hough One-Way tractor sweeper and a blower mounted on a standard wheel type industrial tractor. The sweeper is driven through from the front end of the crank shaft of the tractor and the blower is driven through the rear power take-off.

### New Cab-Over-Engine Trucks

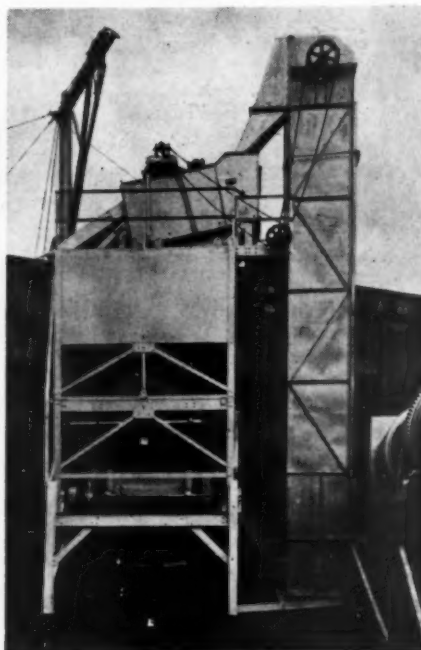
Mack Trucks, Inc., Long Island City, N. Y., has announced production of six new cab-over-engine models rated at from 12,000 to 23,000 lb. gross. Corresponding with the light-capacity models EE, EF, and EG, and the intermediate capacity models EH, EM, and EQ, these six new cab-over-engine trucks are designated respectively as the EEU, EFU, EGU, EHU, EMU, and EQU. Together with the models EC, EB, CH, and CJ, these new trucks now provide Mack with ten truck models of this

available in these models; the EHU, EMU, and EQU, in three standard wheelbase lengths—108 in., 114 in., and 126 in. For these latter three models two special wheelbase lengths of 144 in. and 162 in. are also available. All six models are powered by 6-cylinder engines; the EEU by a  $3\frac{1}{2}$  in. by  $4\frac{1}{2}$  in. engine developing 75 h.p. at 2800 r.p.m.; the EFU by a  $3\frac{1}{2}$  in. by  $4\frac{1}{2}$  in. engine developing 78 h.p. at 2800 r.p.m.; the EGU by a  $3\frac{1}{2}$  in. by  $4\frac{1}{2}$  in. engine developing 85 h.p. at 2800 r.p.m.; the EHU by a  $3\frac{1}{2}$  in. by 5 in. engine developing 90 h.p. at 3000 r.p.m.; the EMU by a  $3\frac{1}{2}$  in. by 5 in. engine developing 90 h.p. at 3000 r.p.m.; and the EQU by a  $3\frac{1}{2}$  in. by 5 in. engine developing 100 h.p. at 2800 r.p.m. In the models EEU, EFU, EGU, EHU, EMU, and EQU, total piston displacement is respectively 253 cu. in., 271 cu. in., 290 cu. in., 309.6 cu. in., 309.6 cu. in., and 353.8 cu. in. The crankshafts of

all these new models have seven bearings and are fully counterweighted on every throw. Crankshafts on the models EHU, EMU, and EQU, are case-hardened. Cylinders are all cast in block of chrome-nickel steel with detachable one-piece heads.

### New Portable Asphalt Plant

A new type of portable asphalt plant having large capacity has been placed on the market by Hetherington & Berner, Inc., Indianapolis, Ind. This company has been building asphalt machinery for the past 40 years and realize a definite need for extremely portable plants for asphaltic road construction. These Model P-A plants are built in four sizes—having mixer capacities of 1500, 2000, 3000, and 4000 lbs. The plant is built in complete sectional units and can be transported on any standard hauling equipment. The portable features of these model P-A plants are not obtained at the expense of plant capacity, operating efficiency, or durability. Each



New Hetherington &amp; Berner Portable Asphalt Plant

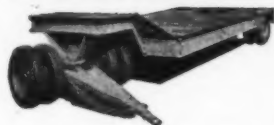
plant is equipped with its own erection equipment—hinged steel mast with jib and hoist having power takeoff. Consequently no outside erection equipment is necessary, and field assembly time is reduced to a minimum. Each unit is completely assembled and the plant has all the latest features developed by Hetherington & Berner, such as their steam-jacketed, steam operated asphalt mixers, steam-jacketed, bottom discharge asphalt buckets, 2-, 3- or 4-deck special enclosed vibrating screens, 4-point suspension dial scales for weigh box and A. C. bucket, 2-, 3- or 4-compartment steel bins with quick acting cut-off gates—hydraulic control for operation of gates can also be furnished if desired.

The units of this plant are designed to comply with most highway loading and road clearance regulations. These plants will process any standard bituminous mixture and will comply with state highway and Federal road specifications.



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## Heavy Duty TRAILERS



The most complete line on the market. Capacities, five to two hundred tons. Four to sixteen wheels. Two to eight axles. They are built to take the heaviest loads safely, and with the least damage to road beds. Write today. Just tell us what you have to move.

LA CROSSE TRAILER & EQUIPMENT CO., LA CROSSE, WIS., U.S.A.  
DIVISION OF LA CROSSE BOILER CO.

THE LARGEST TRAILER  
IN THE WORLD IS A  
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Did you know that—



Three Baker Bulldozers on Allis-Chalmers Tractors, levelling on New York World's Fair Site. Scores of Baker Bulldozers are on the grounds.

The unusually successful performance of Baker Direct Lift Hydraulic Bulldozers and Grade-builders is due to their simplicity, great strength and smooth performance. There are combination moldboards which give scores of added uses for your tractor. Hundreds of leading contractors economize with Bakers.

Ask for Bulldozer Bulletins

THE BAKER MFG. CO., 506 Stanford Ave.  
Springfield, Ill.

# BAKER

## BULLDOZERS

Hydraulic Scrapers  
Road Routers and Discs  
Multiple Blade Maintainers

### LOW COST SOIL STABILIZATION With INGALL'S Sub-Oiling Machine

#### HOW IT WORKS

It consists of a series of teeth mounted on A-shaped frame so that when frame is pulled thru soil grooves left by teeth are 3" apart. Bituminous material is pumped thru hollow teeth, under pressure, depositing a uniform horizontal layer at a predetermined depth below surface of roadway. Moisture evaporation in soil, with rolling and light blading causes material to permeate upward.

#### WHAT IT DOES

Makes possible permanent low cost roads at minimum outlay.  
Eliminates excessive and costly manipulations.  
Permits traffic without serious inconvenience.  
Reduces weather conditions to minimum factor, and in ordinary road mixing operations it may replace conventional distributor with resulting production increase of 100%.

SUB-OILING, INCORPORATED

908 West 25th Street

KANSAS CITY, MO.

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## Hotstuf

### ASPHALT HEATERS

### TOOL HEATERS PAVING TOOLS

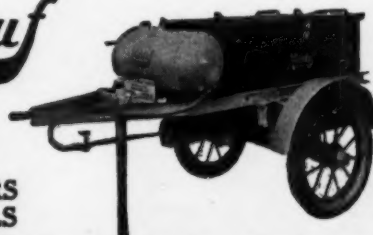
### SURFACE HEATERS — TOOL TRAILERS POURING POTS, ASPHALT SPRAY PUMPS

Dealers in Principal Cities

## MOHAWK ASPHALT HEATER CO.

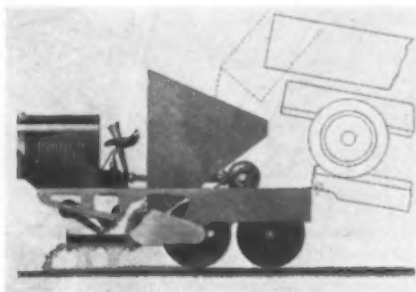
Frankfort

New York



### New Road Surfacing Material Spreader

A new road surfacing material spreader of entirely new design for seal coating and spreading all types of stabilized road materials, has been introduced by the Universal Crusher Co., Cedar Rapids, Ia. Known as the Universal Spreaderoller, this



*The Universal Spreaderoller*

new machine segregates the aggregates into coarse material, medium sized material and fines, depositing them in that order on a freshly sprayed bituminous surface and rolling them smooth all in one operation and with one machine. The Spreaderoller consists of a chassis mounted on three rollers, the third of which is at the back of the machine directly behind the inside edges of the two forward rollers. The two forward rollers are driven and the machine is steered by braking either right or left driven roller. Mounted on the chassis is an industrial power unit and a hopper with mechanical distributor which feeds the aggregates to a shaker screen. A portable ramp is towed by the spreaderoller which permits trucks to back up to and back-dump into the hopper. The machine need be stopped only a matter of seconds, for charging the hopper. This method keeps trucks off the fresh bituminous application.

### New ¾-Yd. Shovel

A new ¾ yd. shovel weighing 36,000 lb. has been announced by The Byers Machine Co., Ravenna, O. It is called Model 83 and is convertible to all boom attachments. This machine was displayed last January at



*Byers ¾ Yd. Model 83*

the Road Show and since then has been operating continuously on a variety of difficult test jobs. On Byers 83, line and swing speeds have been stepped up to increase the number of digging cycles per minute. More power per pound of weight is employed. Pre-formed rolled steel construction provides strength to safely handle the extra power. Lighter overall weight more closely approaches highway load limits, makes moving easier and less expensive and reduces ground bearing pressure. Long boom and dipper sticks increase shovel working ranges. Oversize clutches and brakes make full dippers easy to handle at wide radii. Model 83 uses a 72 h.p. gas or diesel power plant. Major shafts are journalled in anti-friction bearings. All gears on the upper deck have machine cut teeth. Chain or cable types of shovel crowd are optional. Boom and dipper sticks are of pre-formed, rolled steel construction the same as the main revolving frame, carbody and crawler side bolsters. Cast manganese alloy dipper front has integral tooth bases. Deck machinery is balanced far back of the center line of rotation. Boom loads and swing strains are absorbed by four hook rollers which ride on a roller path of wide diameter. Crawler treads are 20 in. wide and of the single driving lug self-cleaning type. The "83" can swing while traveling, steering and hoisting.

## WITH MANUFACTURERS

### Hercules Co. Appoints New Distributors

The Hercules Co., Marion, O., has appointed the following distributors to handle the sale of Hercules road rollers and Iron-erolls in their respective trade areas: Berry & Brown, Marianna, Fla.; Drott Tractor Co., Iron River, Mich.; Jenison Machinery Co., San Francisco, Calif.; Kelly Supply Co., Grand Island, Neb.; George Malvese & Co., New Hyde Park, L. I., N. Y.; Orange State Motor Co., Tampa, Fla.

### New Distributor for Ransome

The Ransome Concrete Machine Co., Dunellen, N. J., has appointed Southeastern Sales Co. of Harlan, Ky., as direct sales representative in a large section of the state of Kentucky. They will handle the complete line of concrete mixers and pavers.

### Koehring Appoints New Distributor

Contractors Equipment Corporation has been appointed by Koehring as a distributor for their complete line of Koehring construction equipment in the Oregon territory. This new corporation is centrally located at 1215 S. E. Grand Ave., Portland, having a large display room for equipment. The personnel, all of whom

have an excellent background of construction and equipment experience, is composed of O. C. Jessup, John W. Miles, Robert D. Vial and Alfred A. Carlson.

### To Sell G. M. Diesels in New England

The K. B. Noble Co., 634 Wethersfield, Ave., Hartford, Conn., has been granted the franchise for the entire New England states for the line of diesel engines now being manufactured by the Diesel Engineering Division of General Motors Corp. The K. B. Noble Co. for over 25 years has distributed heavy power plant equipment and road construction equipment. K. B. Noble is well known to the construction and industrial interests throughout the country. He is a past president of the A. E. D.

### Universal Crusher Appoints Hedge & Mattheis Distributors for New England

The Universal Crusher Co., Cedar Rapids, Iowa, has appointed Hedge & Mattheis Co. of Boston as distributors of Universal crushing, screening and loading equipment and "Chip-Top" spreaderollers for the New England States. The Universal line will be sold and serviced from Hedge & Mattheis Branches at Boston, Springfield and Worcester, Mass.; Providence, R. I.; Portland, Me.; New Haven and Hartford, Conn.; and Concord, N. H.

### Walter K. Dow Elected Vice-President of The Alexander Milburn Co.

At a stockholders' meeting on May 23, 1938, Walter K. Dow was elected vice-president of The Alexander Milburn Co., Baltimore, Md. Before becoming associated with Milburn, Mr. Dow was identified with the DeVilbiss Co., at Toledo, O., for ten years in a manufacturing and supervisory capacity of paint spray equipment. Mr. Dow has been plant superintendent of the Milbourn Co. for the past year and is especially skilled in the development and production of their line of paint spray equipment, welding and cutting apparatus, portable lights, etc.

### Greenough Appointed Manager of Federal Trucks Chicago Factory Branch

The appointment of Al J. Greenough as manager of the Federal Motor Truck Co.'s factory branch in Chicago, has been announced by K. M. Schaefer, General Sales Manager of Federal. Greenough's long experience in the merchandising of trucks has centered in the Chicago territory. Before his connection with Federal he was, for a number of years, truck manager of the M. J. Lanahan Co., Dodge distributors in Chicago, and previous to that he handled sales in that city for the Nelson-La Moon Co.



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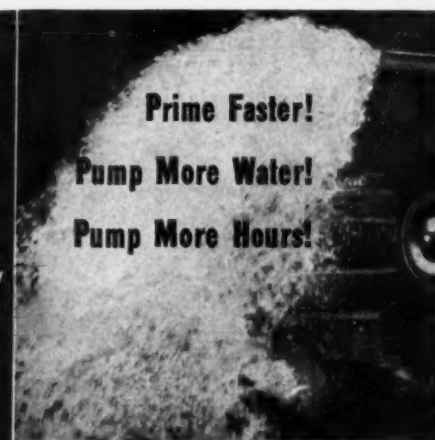
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### Bode-Finn Appointed Distributor for Bucyrus-Erie

Bode-Finn Equipment Co., Inc., 1654 Central Ave., Cincinnati, O., has been appointed distributor in southern Ohio by Bucyrus-Erie Co., South Milwaukee, Wis. Bucyrus-Erie shovels, draglines, clamshells, and lifting cranes, ranging from  $\frac{3}{8}$  to 2-yd. sizes, will be sold by the Bode-Finn Equipment Company, Inc. This new distributor will work with the cooperation of the Bucyrus-Erie branch office, 1502-03 Clark Bldg., Pittsburgh, Penn.

### Thornton Tandem Co. Moves

The Thornton Tandem Co. has announced the removal and consolidation of its Braden Avenue and McKinstry Street plants into a larger factory building, located in the Northeast section of Detroit. The building which contains 29,840 sq. ft. of floor space, is situated on a five acre site at 8701-79 Grinnell Ave. with Detroit Terminal R. R. siding facilities. This expansion move is being made in compliance with business demands to facilitate shipments and group installations.

## NEW LITERATURE

**Sieves.**—Bulletin 222 covering its line of sieves has been published by the Precision Scientific Co., 1736 N. Springfield Ave., Chicago, Ill. Six pages. Shows U. S. standard sieves as specified by the American Society for Testing Materials, American Association of State Highway Officials and U. S. Government highway departments. Also lists various other types of sieves and screens for grading sand, stone and soil.

**Calcium Chloride in Stabilization Work.**—To provide engineers and road officials with practical and technical information on the value of calcium chloride in stabilized soil mixtures, the Calcium Chloride Association has recently issued a brief entitled "The Stabilizing Effects of Calcium Chloride." This leaflet, quoting largely from data developed by the U. S. Bureau of Public Roads, tells how and why the use of calcium chloride produces greater density and better compaction of soil mixtures and answers many questions on the behavior of soils. A copy of this new brief, No. 134, may be obtained by request addressed to the Calcium Chloride Association, 4145 Penobscot Bldg., Detroit, Mich.

**Soil Stabilization.**—"Soil Stabilization with Tarvia" is the title of a booklet that has just been issued by The Barrett Co., 46 Rector St., New York, N. Y. Amounts and grades of Tarvia are discussed. The booklet also contains a description of construction procedure. It is well illustrated.

**Wood Pipe and Tanks.**—Containing data, designs and reference tables which in many instances have not hitherto been published, National Tank & Pipe Co., Kenton Station, Portland, Ore., has just issued two catalogs, one describing wood pipe, the other, wood tanks. The "Wood Pipe Handbook" contains 265 pages and over 150 illustrations. The subject matter ranges from an

authoritative section on hydraulics to a description of the manufacture and application of wood pipe. Especially valuable is a section in which problems encountered by engineers are solved both scientifically and through the use of flow tables prepared especially for this handbook. "Wood Tank Catalog No. 37" describes tank installations of a wide variety. It shows how tanks and their foundations are designed and erected. Typical illustrations make perfectly clear many features of tank construction not usually published.

**Hard-Facing Electrodes.**—A bulletin has been issued by J. D. Adams Co., Indianapolis, Ind., announcing a new hard-surfacing electrode which has just been put on the market. This hard-surfacing material has been developed for the hard facing of road building and excavating equipment where it is subject to abrasion. It is stated to be entirely different from any hard-surfacing materials now on the market and to have the advantage of extreme ease of application.

**Testing Apparatus.**—A new Bulletin No. 1, illustrating and describing its line of hardness testing machines, has been issued by Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia. The bulletin contains a description of the new direct reading production Brinell machine.

**Compressors.**—Sullivan Machinery Co., Michigan City, Ind., has issued a revised edition of a bulletin on single-stage horizontal compressors, Class WG-7. This includes illustrations and descriptions of an improved "dual-cushion" valve now being used in these machines.

**Internal Combustion Engines.**—A new 36-page booklet, illustrating various installations of diesel and gas engines, has been published by Worthington Pump & Machinery Corp., Harrison, N. J. Among the first in America to build internal combustion engines, Worthington pictures in this new publication the extensive application of diesel and gas engines in every field where power is an essential factor.

**Trailers.**—Three new pictorial folders have just been issued by the Highway Trailer Co., Edgerton, Wis., showing their two new standardized trailers. One folder illustrates the new Highway "Roadmaster" unit for transporting moist or refrigerated lading; another features the new "Freightmaster" unit for hauling dry lading, and the third folder shows many of these trailers already in use throughout the country.

**Mixers and Agitators.**—A new catalog on the Rex Moto-Mixers and Moto-Agitators has been brought out by the Chain Belt Co., Milwaukee, Wis. The catalog illustrates and describes the outstanding features of Rex Moto-Mixers and Moto-Agitators, with their uses, construction details and specifications. Rex Moto-Mixers and Agitators are made in all standard sizes from 1 yd. to  $7\frac{1}{2}$  cu. yds. A number of outstanding features

of Rex Moto-Mixer are highlighted and among these features are the Rex fast-mixing cone-end drum, the Rex safety 3-point drum mounting, the Rex one-lever non-gear shifting drum control, the Rex outside discharge control, the Rex shock-absorbing drum drive, the Rex one-man jiffy spout, and the Rex non-flooding water tank. In the center of the book is a map showing where Rex Moto-Mixer fleets are located.

**Earth Moving.**—Earth moving in all parts of the world and under all types of climatic and soil conditions, is illustrated and explained in a new booklet, issued by Caterpillar Tractor Co., Peoria, Ill. Airport work, road construction, road maintenance, railways, reservoirs and general construction work are allotted separate divisions in the booklet. Allied equipment and its proper application on earth-moving work, as well as cost figures, are considered. Each job mentioned is illustrated with action pictures taken on the spot.

**Tank Car Heaters.**—A new catalog has been issued by Cleaver-Brooks Co., 135 W. Wells St., Milwaukee, Wis., illustrating and describing their new streamlined steam tank car heaters, their automatic heaters for asphalts, tars and other bituminous materials, and their new tank car unloading valve and line of Oilbilt steam generating plants. All this equipment is fully described and numerous illustrations of important features are shown.

**Testing Apparatus.**—Apparatus for testing soils, cement and concrete are covered in Bulletin 221, published by the Precision Scientific Co., 1736 N. Springfield Ave., Chicago, Ill. Twenty pages are devoted to apparatus conforming to standard specifications of the American Society for Testing Materials and American Association of State Highway Officials, for testing cement, concrete, lime, gypsum and soils. Bulletin includes detailed information on U. S. Standard sieves and screens, also data on other types of sieves and screens for grading stone and soils.

**27-E Paver.**—A large, attractive two-colored broadside, 22x16, featuring the new Ransome 27-E pavers with hydraulic control and other late features, has been issued by the Ransome Concrete Machinery Co., Dunellen, N. J.

**Wagon Scrapers.**—The Continental Roll & Steel Foundry, Tractor Equipment Division, East Chicago, Ind., has issued Bulletin 109, which concisely covers their entire line of wagon scrapers in 4, 5, 7 and 10 yd. sizes, both low pressure tire and crawler mounted. Various Continentals at work on dirt moving jobs are illustrated including highway construction and relocation jobs, stripping overburden in mines and gravel pits, building railroad right-of-ways, etc. Complete specifications, weights, dimensions, etc., are also given.

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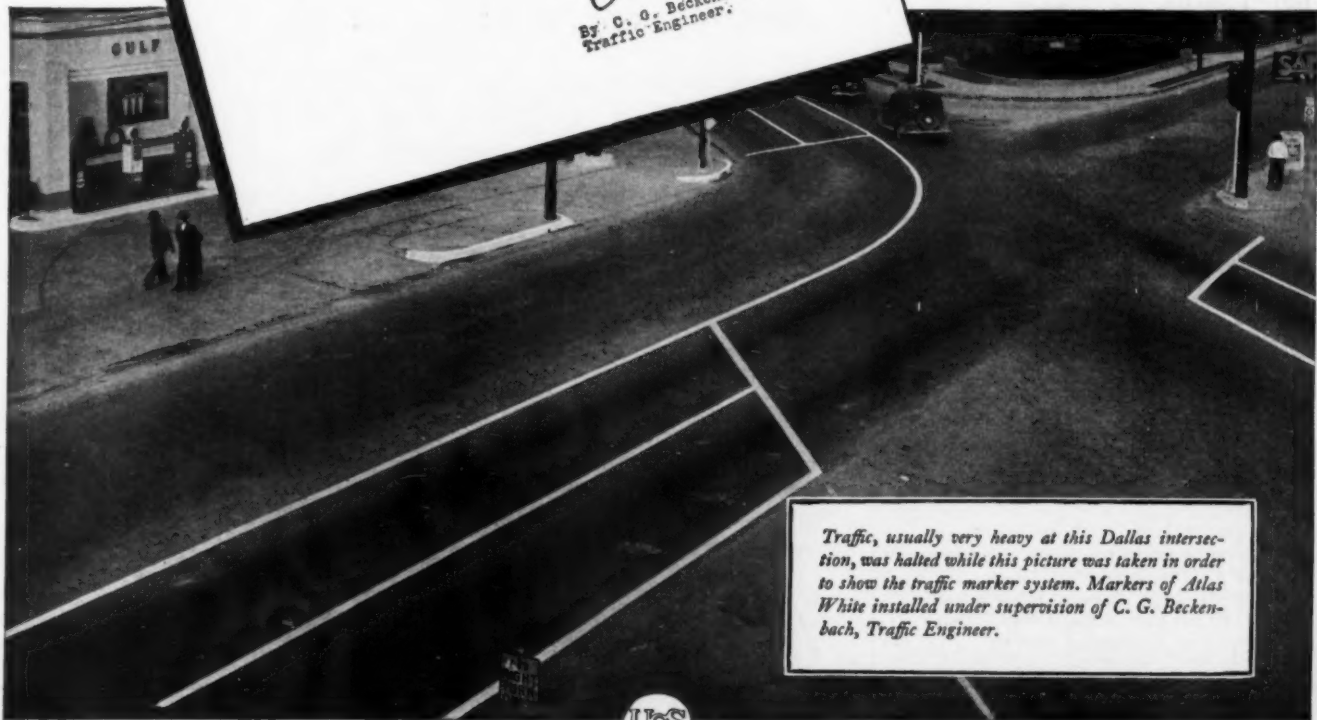
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M-21



Traffic, usually very heavy at this Dallas intersection, was halted while this picture was taken in order to show the traffic marker system. Markers of Atlas White installed under supervision of C. G. Beckenbach, Traffic Engineer.



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DID YOU KNOW THAT—..... 10-77-79

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